

Work Assignment No. 6  
MTA Agreement No. 15099-0300

## Utica Avenue Transit Improvements Study

# Task 2 Deliverable 2: Flatbush Av Terminal

December 2020

Prepared for:



Submitted by:



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# 1 Executive Summary

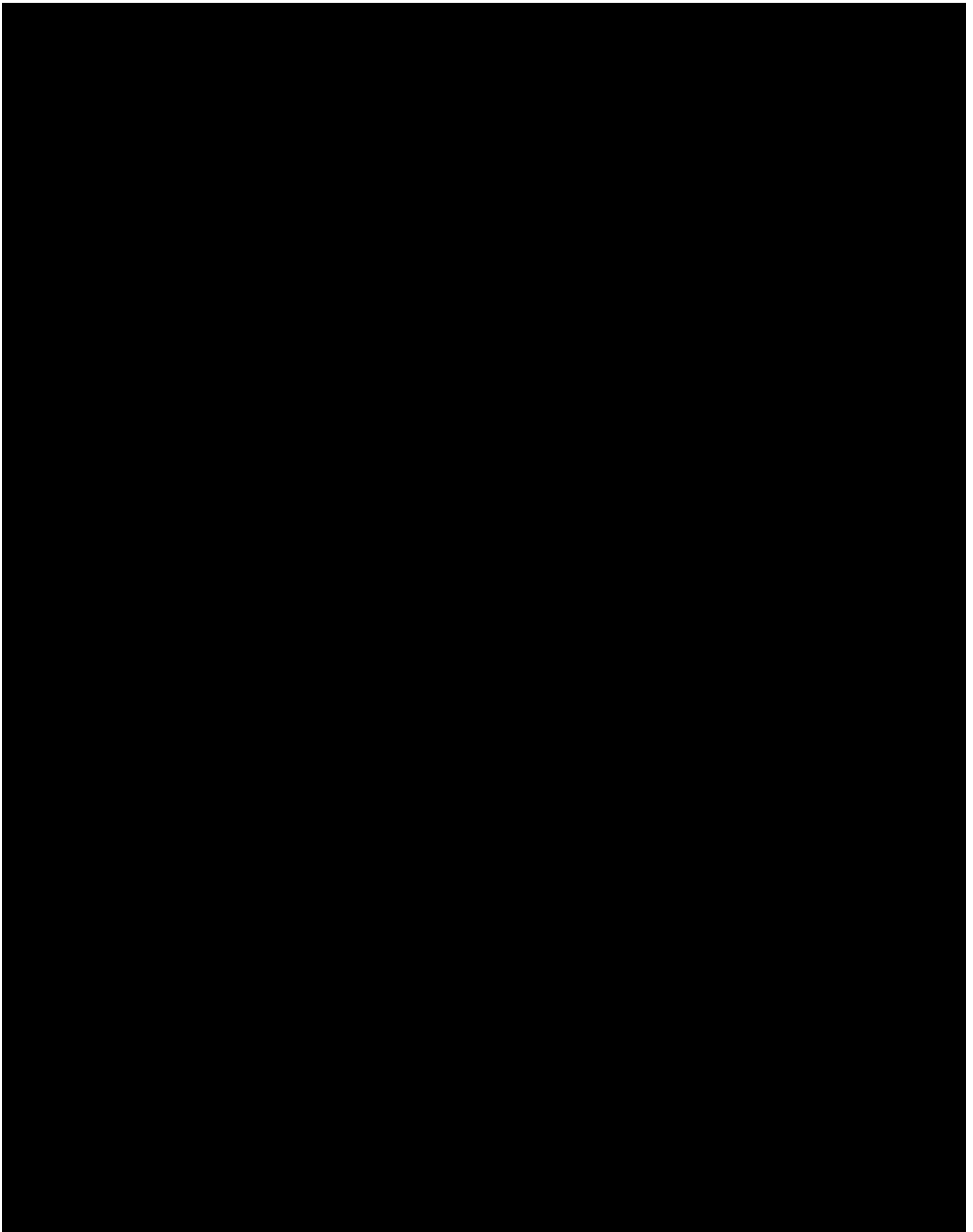
This report is developed by WSP as part of the Utica Avenue Transit Improvements Study and focuses on Flatbush Av Terminal, a two-track, dual side platform terminal station for the 2 and 5 on the Nostrand Av Line (A-Division). Flatbush Av Terminal is under consideration as one of five stand-alone study locations where operational and capacity improvements could be made to the existing A-Division subway system in Brooklyn that would complement, but be independent of, any potential transit improvements along the Utica Avenue corridor. The five study locations are analyzed to identify methods to increase the capacity and operational flexibility of the A-Division in eastern Brooklyn and offer solutions to alleviate constrained conditions due to train operation bottlenecks and the lack of train lay-up capability.

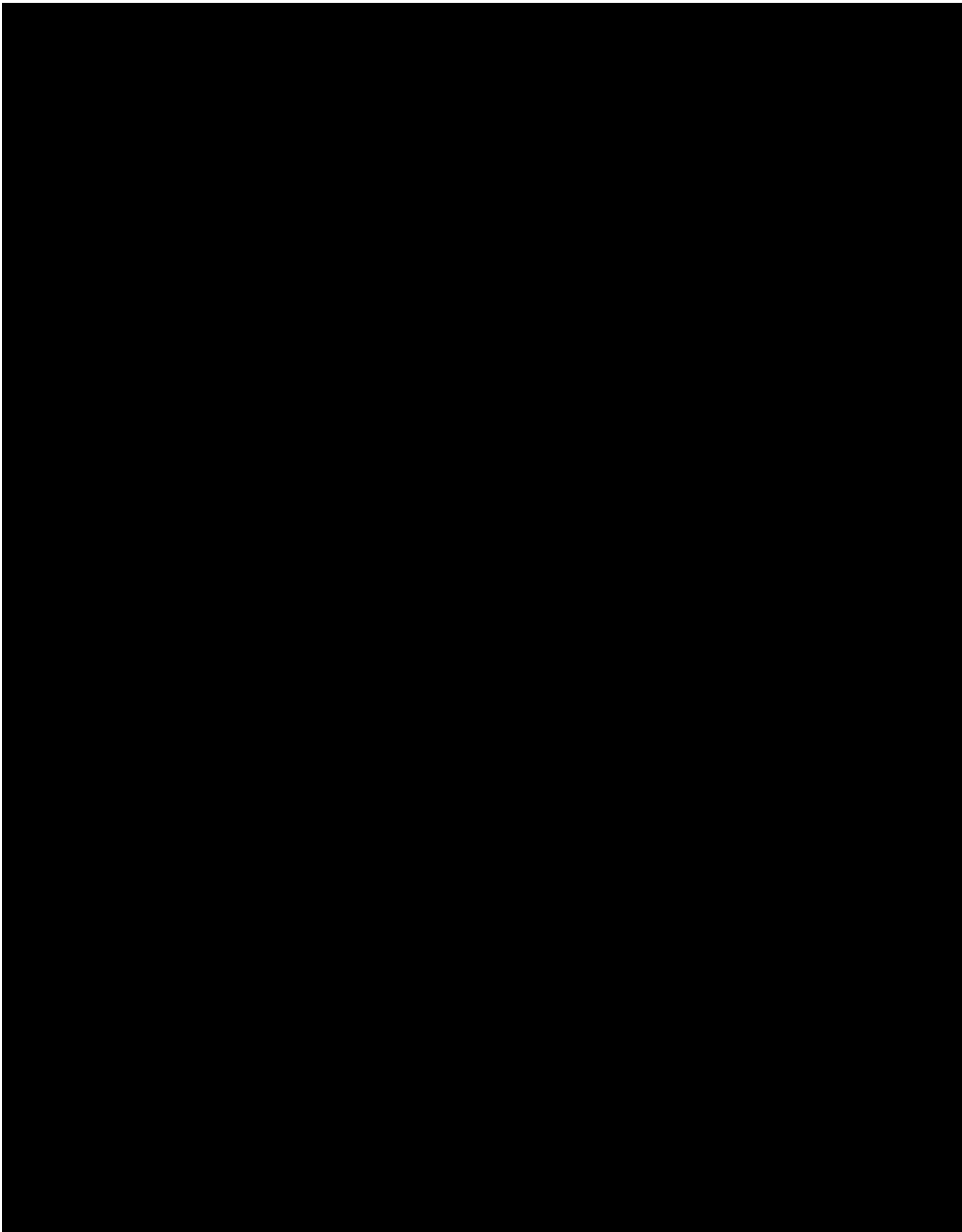
At Flatbush Av Terminal, the existing platform configuration and the lack of an overrun track has hindered train operations as a terminal station since the Nostrand Av Line was opened in 1920. Assigning the 2 to the northbound platform and the 5 to the southbound platform operationally creates a station with dual single platforms and no surplus platform capacity to absorb delays.

For subway customers, access between the dual platforms are limited to a single point of connection; the relatively narrow, horseshoe-shaped passageway located at the south end of both platforms. This inhibits customer access between the two platforms and tends to create uneven train loadings on the platform used by the 5.

In addition to the operational constraints, no train storage capacity exists near Flatbush Av Terminal. Trains assigned to and serving the Nostrand Av Line are generally dispatched from the 239th Street and East 180th Street Yards located in the Bronx. New train storage tracks near Flatbush Av would provide new A-Division train storage, which would be beneficial given the increase in Trains Per Hour (TPH) and the corresponding increase in fleet size enabled with the implementation of Communications-Based Train Control (CBTC). Such proximate train storage would also provide for laying-up disabled trains and/or storing spare trains to be inserted into service to replace a failed train.

This report studied Flatbush Av Terminal to ascertain viable methods to improve the operations and provide proximate trainset storage. The analysis was accomplished by reviewing prior work by NYCT, brainstorming to identify other potential improvements, and analyzing the constructability and effectiveness of various modifications.






## 2 Introduction

This report, developed as part of the Utica Avenue Transit Improvements Study (hereafter, Utica Avenue Study), recommends possible infrastructure improvements at Flatbush Av Terminal. Flatbush Av Terminal is one of the five stand-alone study locations where operational and capacity improvements could be made to the existing subway system, complementary to but independent of any potential transit improvements along the Utica Avenue corridor. The intent of the five study locations is to identify methods to increase the existing A-Division<sup>5</sup> capacity and operational flexibility in eastern Brooklyn, and to offer a range of solutions to alleviate existing constrained conditions pertaining to train operation bottlenecks and shortage of train storage or lay-up capability. The other four locations are Nostrand Junction, Crown Heights/Utica Av Terminal, New Lots Av Terminal, and Livonia and Linden Yards (Figure 1).

The infrastructure improvements discussed in this report would increase terminal capacity and address the potential need for additional A-Division train storage after the implementation of Communications-Based Train Control (CBTC).

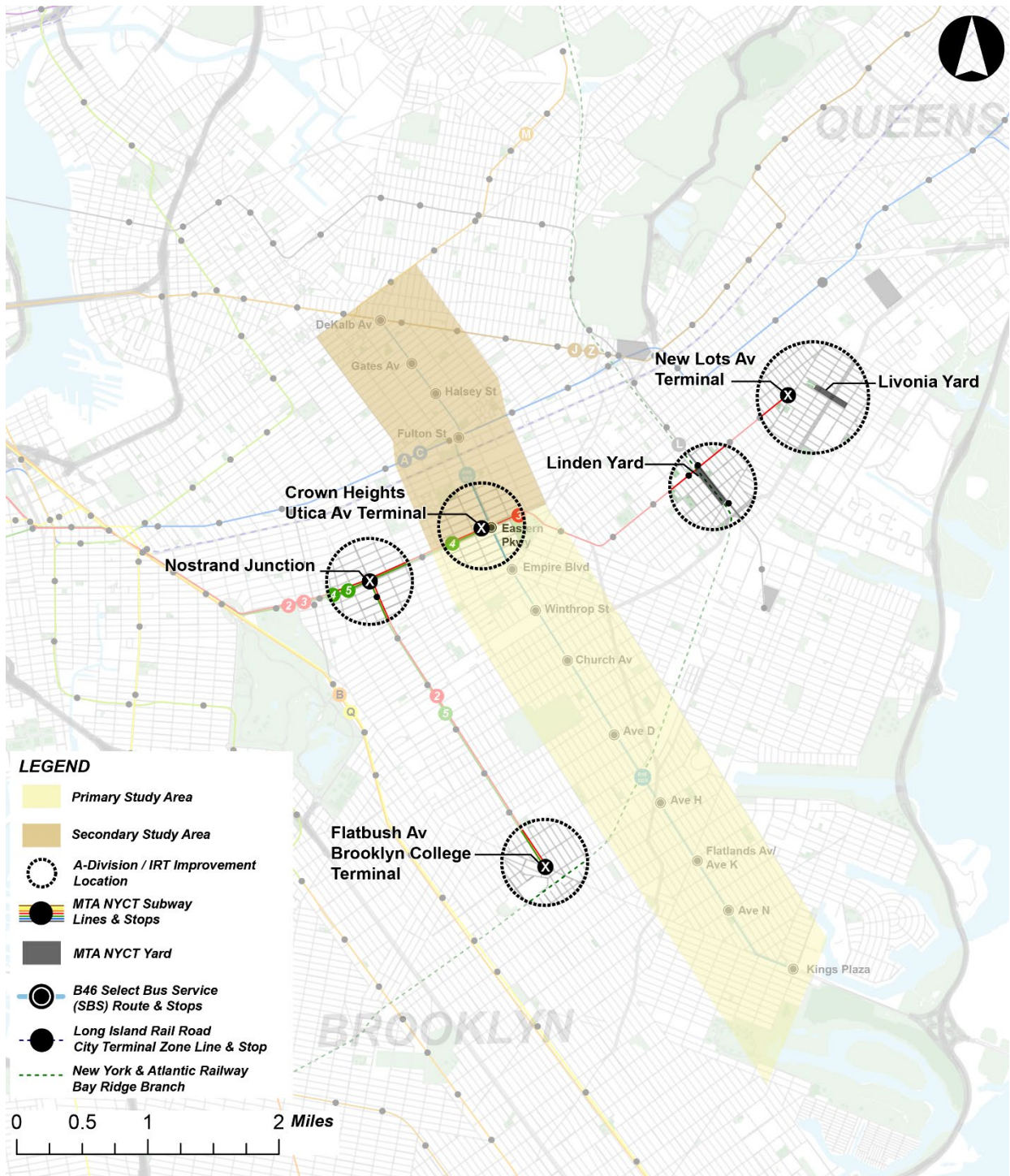


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<sup>5</sup> Appendix A contains a Glossary of Terms.



Figure 1. Study Area and A-Division Improvement Locations for the Utica Avenue Transit Improvements Study



Source: Utica Ave Study

## 3 Existing Conditions and Constraints

### 3.1 EXISTING INFRASTRUCTURE AND OPERATIONS

Flatbush Av Terminal is a two-track, dual-side platform station and is the southern terminus for the Nostrand Av Line (A-Division), which serves the 2 and 5. This station is beneath Nostrand Avenue and Flatbush Avenue, the meeting point of two major arterial streets. According to the 2019 NYCT Analysis, this station was not planned to be a terminal station; it was envisioned to be a through station because the Nostrand Av Line was planned to extend farther south. As a result, this station has two tracks and two side platforms instead of the typical terminal station configuration that contains several platforms and multiple platform tracks (Figure 2 and Figure 3).

Today, three fare control areas exist (one of which is staffed). The fare control areas are at the same elevation as the two side platforms, and the platforms are accessible from the street via multiple staircases. This station is Americans with Disabilities (ADA) accessible; the ADA-compliant elevator from street level to the platform is at the southeast corner of Nostrand Avenue and Flatbush Avenue.

The sole underground access between the southbound and northbound platforms is at the south end of the side platforms, via a narrow, horseshoe-shaped, platform-level walkway that wraps around the bumper blocks of the two tracks.

During weekdays, from approximately 6:00 AM to 9:00 PM, the 2 and 5 serve this station, providing customers with a one-seat ride to either the West Side IRT Line or East Side IRT Line, respectively. Typically, the 2 departures are dispatched from the northbound platform (Track D3) and the 5 departures are dispatched from the southbound platform (Track D2). These platform assignments enable Manhattan-bound customers boarding at Flatbush Av Terminal to easily find their desired train and to provide certainty of train departure location. Reduced service is in effect during weekends and overnight hours, when only the 2 serves Flatbush Av Terminal.

Alternatively, if platform assignments were not used during weekday service, and instead there were random assignments of departing 2 and 5 services from the two platforms with train destinations announced just before departure, this could result in an issue as to where customers should wait within the limited confines of the station. Unlike stations with an island platform, it is more difficult for customers to board trains at a station with a dual side platform configuration because they would not know which platform to wait on for their train. The sole connection at this station is a single horseshoe-shaped walkway at the very south end of the platform. The need for passengers to relocate from one platform to the other at the last minute could create a bottleneck for passenger flow.

To the north of the station platforms, a #8 diamond crossover enables arriving southbound trains to access the appropriate station platform track and allows departing northbound trains from southbound Track D2 to access northbound Track D3.

Approximately 500 feet south of Flatbush Av Terminal is the LIRR Bay Ridge Branch. This freight-only rail line extends from Fresh Pond Junction in Glendale, Queens to the 65<sup>th</sup> Street Yard in Bay Ridge, Brooklyn. At Fresh Pond it becomes the CSX Transportation Fremont Secondary to the Bronx and there is a connection to the LIRR Montauk Branch to Long Island City and eastern Long Island. At the 65<sup>th</sup> Street Yard a railcar float facility connects across the New York Bay to the Conrail Greenville Yard in Jersey City, NJ. These

connections provide freight rail customers in Brooklyn and Queens and on Long Island with valuable access to the nationwide rail network. The stretch of the Bay Ridge Branch right of way of interest is between Nostrand Avenue and the Brighton Line overpass, located between East 15<sup>th</sup> and East 16<sup>th</sup> Streets; approximately 3/4-mile, with a width of about 110 feet (Figure 4). The right of way contains a single freight track in an open cut. It is mostly overgrown with vegetation with portions featuring sloped embankments up from the track level to the street level above. Two overhead bridges span the LIRR Bay Ridge Branch within the area of interest, one at Bedford Avenue and the other at Ocean Avenue.

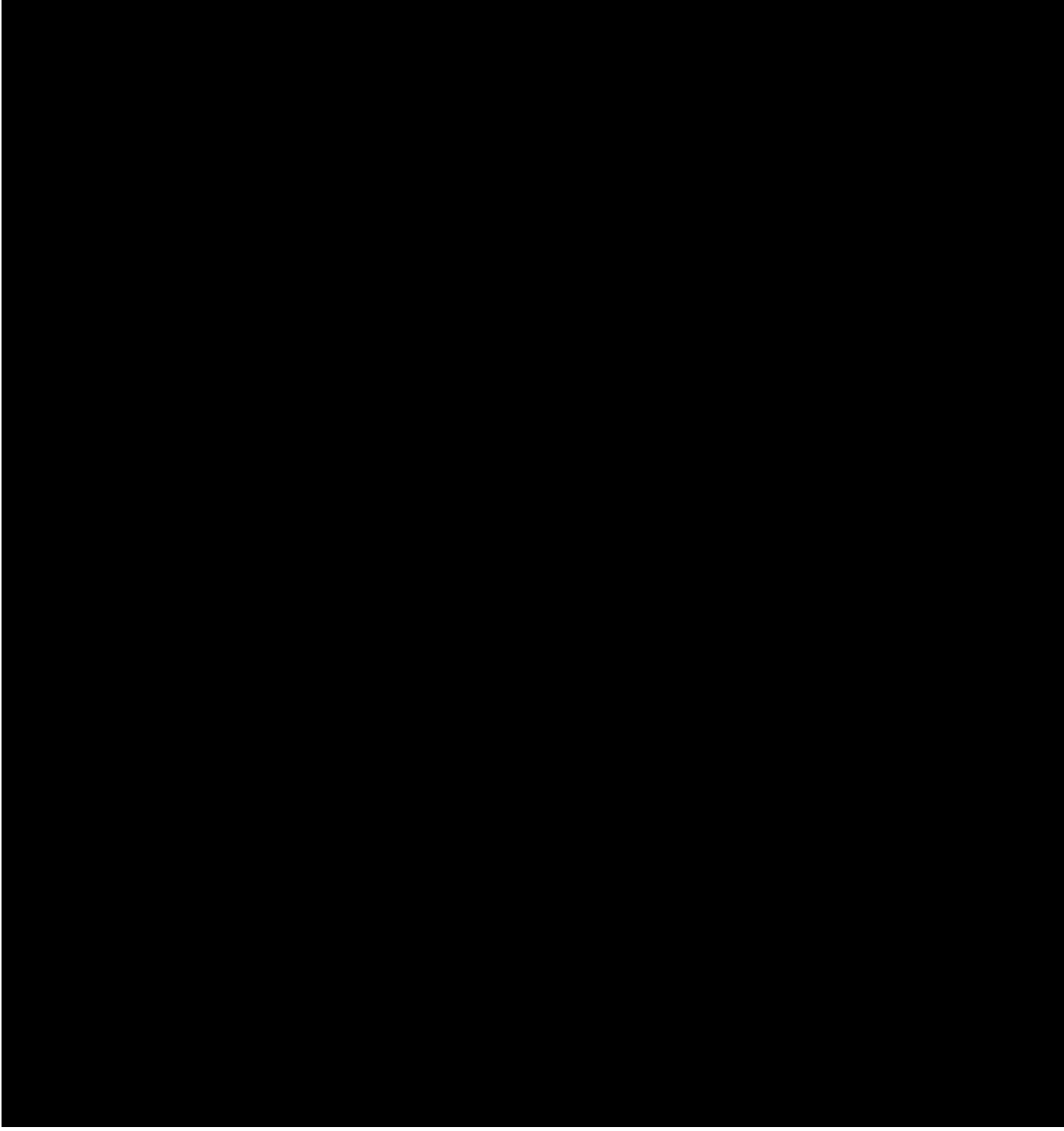
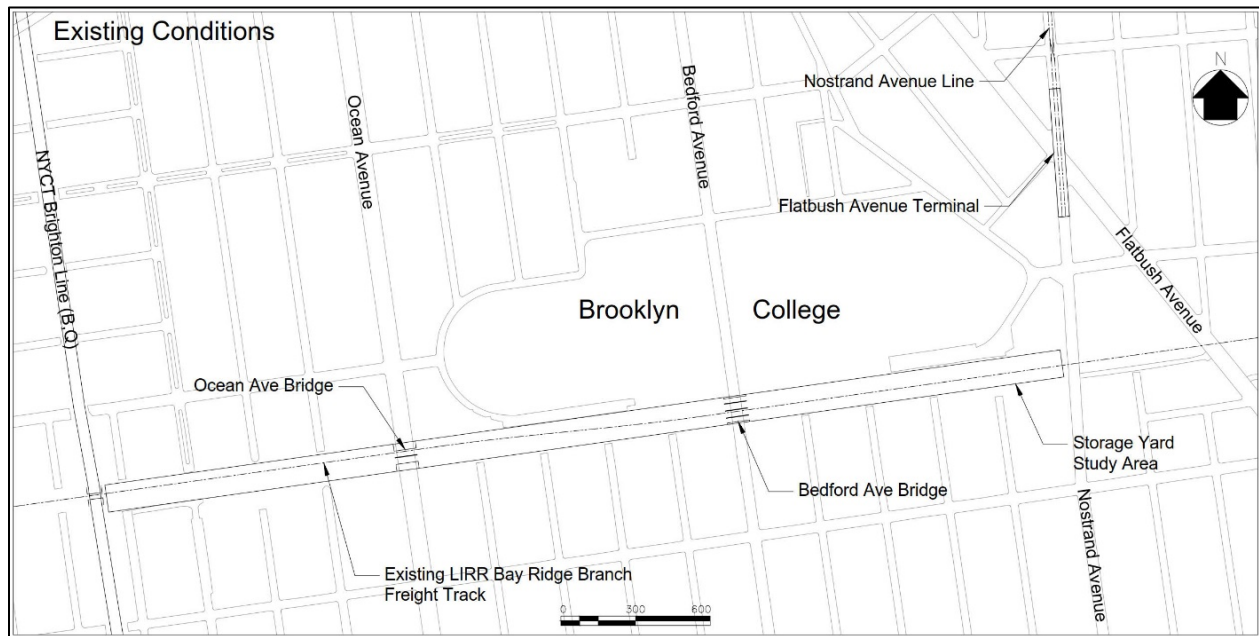


Figure 4. Existing Conditions at the LIRR Bay Ridge Branch Right of Way



Source: Utica Ave Study

### 3.2 EXISTING OPERATIONAL CONSTRAINTS

While the crossover north of Flatbush Av Terminal permits trains to diverge across at 15 MPH, trains entering the station must do so at 5 MPH because they are approaching the bumper blocks. Without a track overrun space, trains cannot enter this station at a speed higher than 5 MPH. As a result, with the existing signal system the terminal's practical capacity according to NYCT is limited to 18 trains per hour (TPH), which is quickly realized during peak periods.

For comparison, the newly constructed 34<sup>th</sup> Street-Hudson Yards Station on the 7 extension has a #8 crossover north and a #6 crossover south of the station, along with tail tracks south of the station that provide overrun length and trainset storage capacity. At this station, trains can enter or depart at track speed on "straight rail" travel, and through diverging movements over the crossovers at 15 MPH. The tail tracks also provide proximate storage for up to six trainsets. The overall capacity of the 7, which now has CBTC installed throughout, is 29 TPH.

The 2 trains berthing at the northbound platform and the 5 trains berthing at the southbound platform result in Flatbush Av Terminal operating as two independent single-track terminals, without redundant platform capacity. This operation can result in train delays if successive trains arrive and need to access the same assigned platform and that platform track is already occupied. Ideally, trains arrive at Flatbush Av Terminal in an alternating sequence of 2 and 5 trains; however, delays elsewhere on the system can result in trains arriving out of order. This operation requires an arriving southbound train to wait north of the station for its assigned platform track to become available, even if the other platform track is unoccupied. If the delay is lengthy, two southbound trains could be held north of Flatbush Av Terminal, with the second train seeking to enter the available, open platform track, but unable to do so because the train ahead is blocking its path into the station. For example, if a southbound 5 is waiting for station platform Track D2 to clear,

the southbound 5 must hold north of the diamond crossover. Meanwhile, the following southbound 2 seeking to enter vacant station platform Track D3 cannot enter that track because the southbound 5 ahead is blocking its path to Track D3. These types of delays extend customer journey times, degrade subway schedule reliability, and can cause delays that ripple onto other trains.

According to NYCT, extra time is built into the train schedules to allow minor delays to be recovered at the terminals. However, the lack of extra station platform or storage track capacity at Flatbush Av Terminal makes it difficult to add this extra recovery time to an individual train trip during peak periods. This condition is worsened by the fact that today, the station essentially operates as two single track terminals; the southbound track (D2) for the 5 and the northbound track (D3) for the 2. If a southbound train arrives early, there is no place for that train to dwell without potentially affecting following trains. This can exacerbate delays on the Nostrand Av Line and entire northbound trips (Manhattan bound) may be cancelled if a southbound (Flatbush bound) train incurs lengthy delays.

In addition to the operational constraints associated with this terminal, no relief train storage capacity exists near Flatbush Av Terminal. Relief storage would provide opportunities to store a mechanically compromised train while it is repaired or until the end of a peak period when it would be less risky to operate it on the mainline to a yard or to store a spare train, ready for insertion into revenue service in place of a disabled train.

## 4 No Build Conditions for Flatbush Av Terminal

### 4.1 SITE-SPECIFIC CHANGES

Absent the work associated with this study, no site-specific changes are planned, programmed, or committed through the 2035 horizon year at Flatbush Av Terminal.<sup>6</sup> Thus, the existing Flatbush Av Terminal, plus the addition of CBTC as discussed below, constitutes the No Build condition at this location.

### 4.2 COMMUNICATIONS-BASED TRAIN CONTROL

*Fast Forward: The Plan to Modernize New York City Transit* (hereafter, Fast Forward Plan) is a 10-year look ahead plan that sets forth a vision to reimagine the subway system. A key element of the plan is the installation of CBTC signaling that has been proposed to replace segments of the existing fixed-block signaling system. CBTC is considered more reliable than fixed-block signaling, offers train dispatchers more accurate train location information, and has the potential to increase the number of trains running on each line by having trains controlled more precisely and running closer together. Specifically, with CBTC, trains can be operated in Automated Train Operation (ATO) mode which reduces train performance variability among train operators, thereby controlling trains more precisely and dynamically ensuring safe separation of trains.

The Fast Forward Plan does not propose to install CBTC on the A-Division Lines east of Nevins Street Station in the first 10 years of plan implementation. However, NYCT's A-Division Capacity Study includes train operations simulation analyses with CBTC installed and active throughout the Brooklyn A-Division Lines. Furthermore, NYCT has directed that the service plans and simulations to be performed as part of the Utica Avenue Study should use the A-Division Capacity Study simulation models with CBTC as a basis for evaluation of the Utica Avenue Study improvements packages. As such, the Utica Avenue Study is proceeding with CBTC as part of the No Build condition.

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<sup>6</sup> The MTA *Twenty-Year Capital Needs Assessment 2015-2034* identifies the following strategy to “alleviate hotspots,” but no improvements are planned, programmed, or committed: “Rebuilding critical subway junctions where lines merge and separate (such as Nostrand Junction on the 2 3 4 5 lines) to maximize train throughput and reduce delays.”

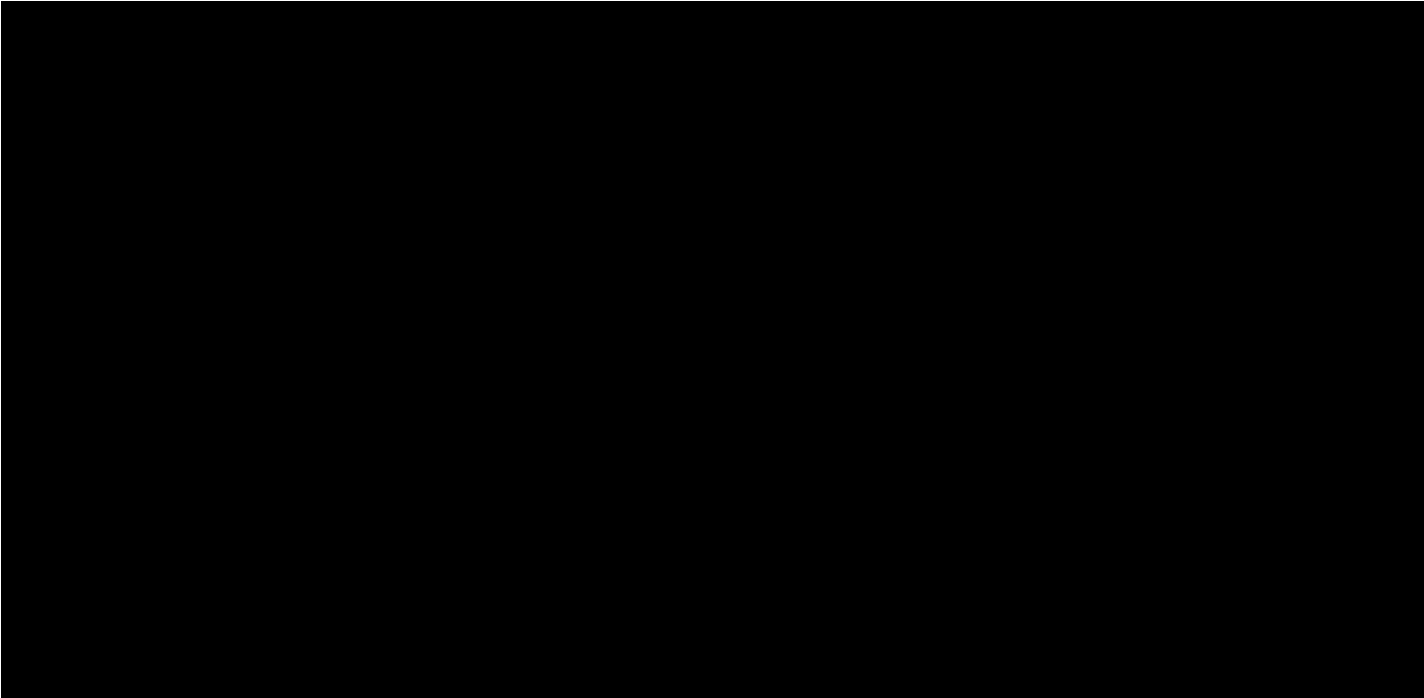
## 5 Previous Studies for Improving Operations





### 5.2.1 2019 NYCT Analysis Phase 1

In Phase 1, the existing #8 crossover located north of the terminal (Figure 6) would be replaced by a new #10 crossover (Figure 7)<sup>7</sup> to permit faster transit times over that crossover. This upgrade could be accomplished within the structural footprint of the existing crossover north of the station and would not require any structural changes within the existing tunnel.



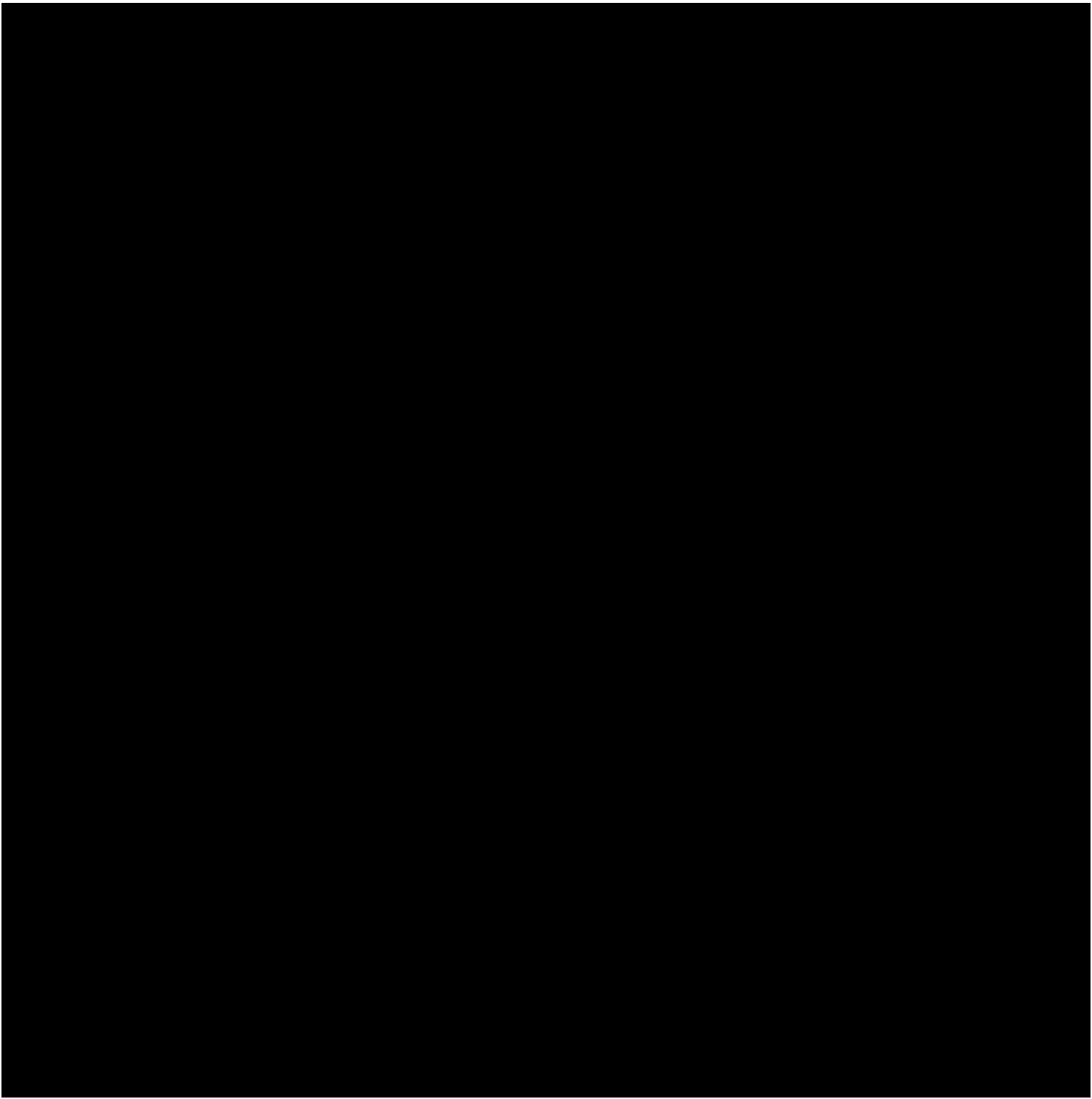
<sup>7</sup> The #10 crossover is rated for 26 MPH, however, NYCT operates at 25 MPH to provide for a 1 MPH underspeed safety margin.





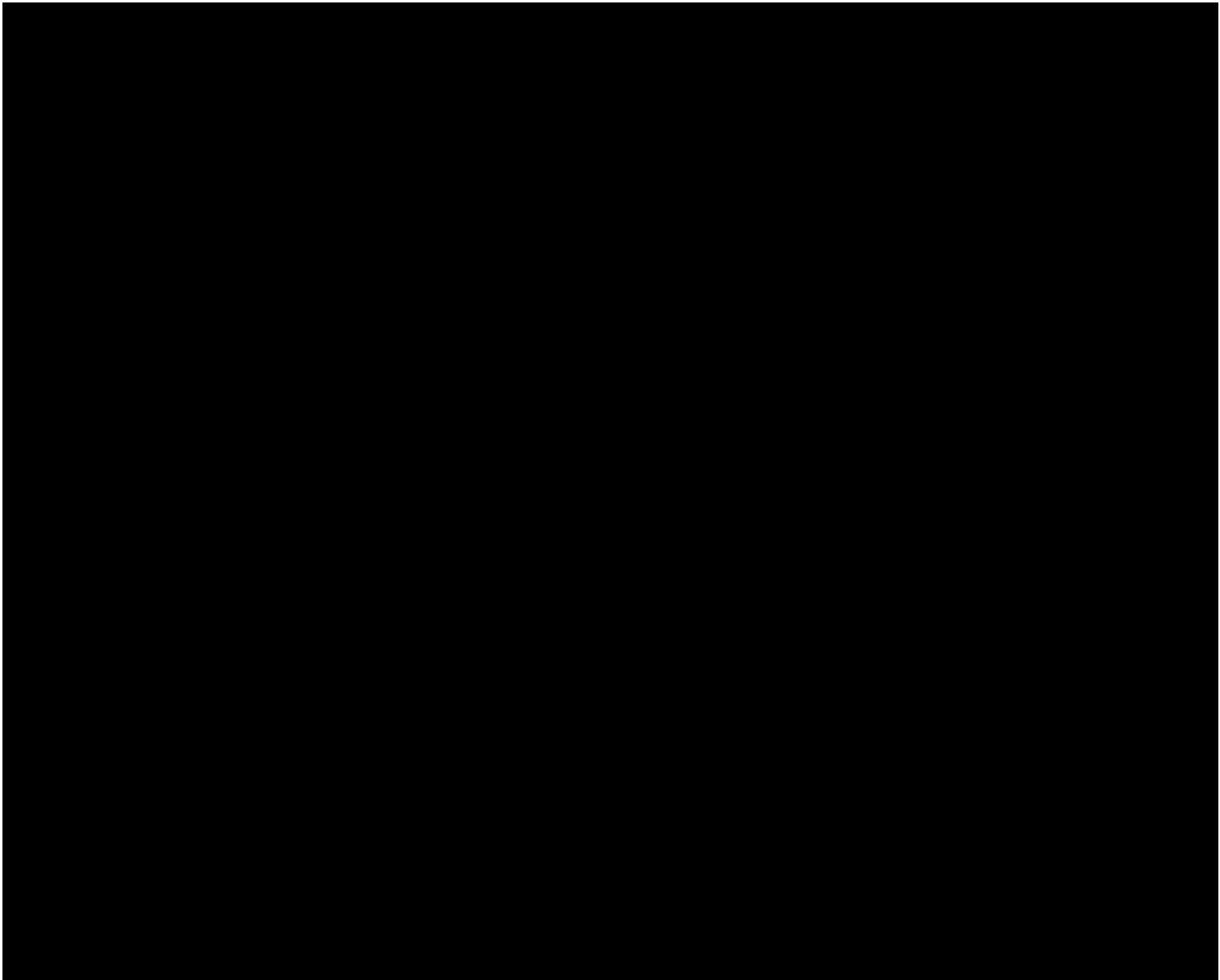
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<sup>8</sup> Additionally, Utica Ave Study team member LTK performed targeted micro-simulations for the Phase 1 improvements as part of the A-Division Capacity Study.



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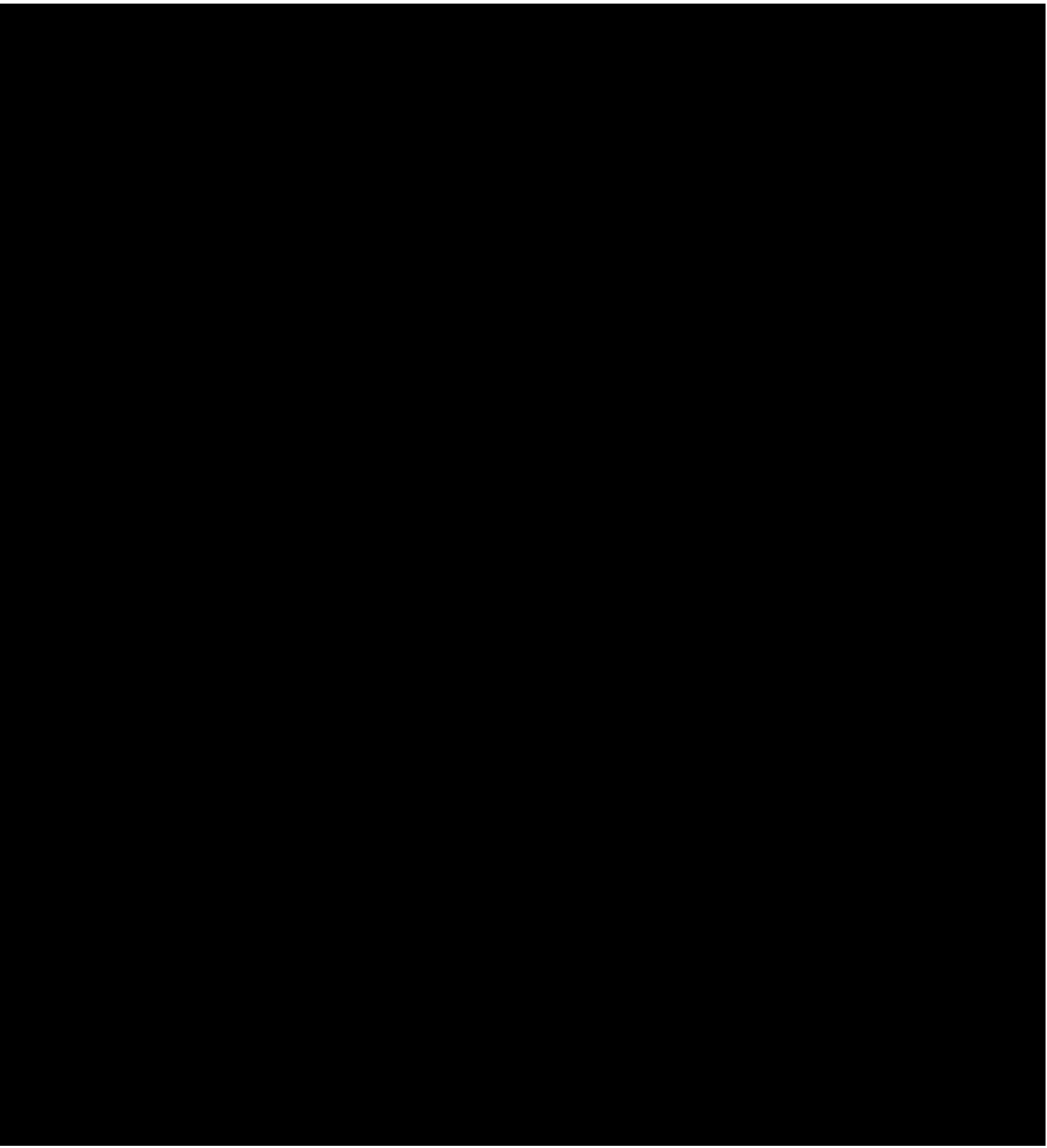
<sup>9</sup> Appendix C in this Utica Avenue Study deliverable discusses a potential impediment to the use of Block 7575, Lot 53 for purposes of the Flatbush Avenue Terminal infrastructure improvements. Specifically, Appendix C summarizes publicly available information (as of fall 2019) regarding the status of development plans from Brooklyn College that may affect the proposed NYCT improvements at this location.





<sup>11</sup> <https://www.panynj.gov/port/cross-harbor.html>

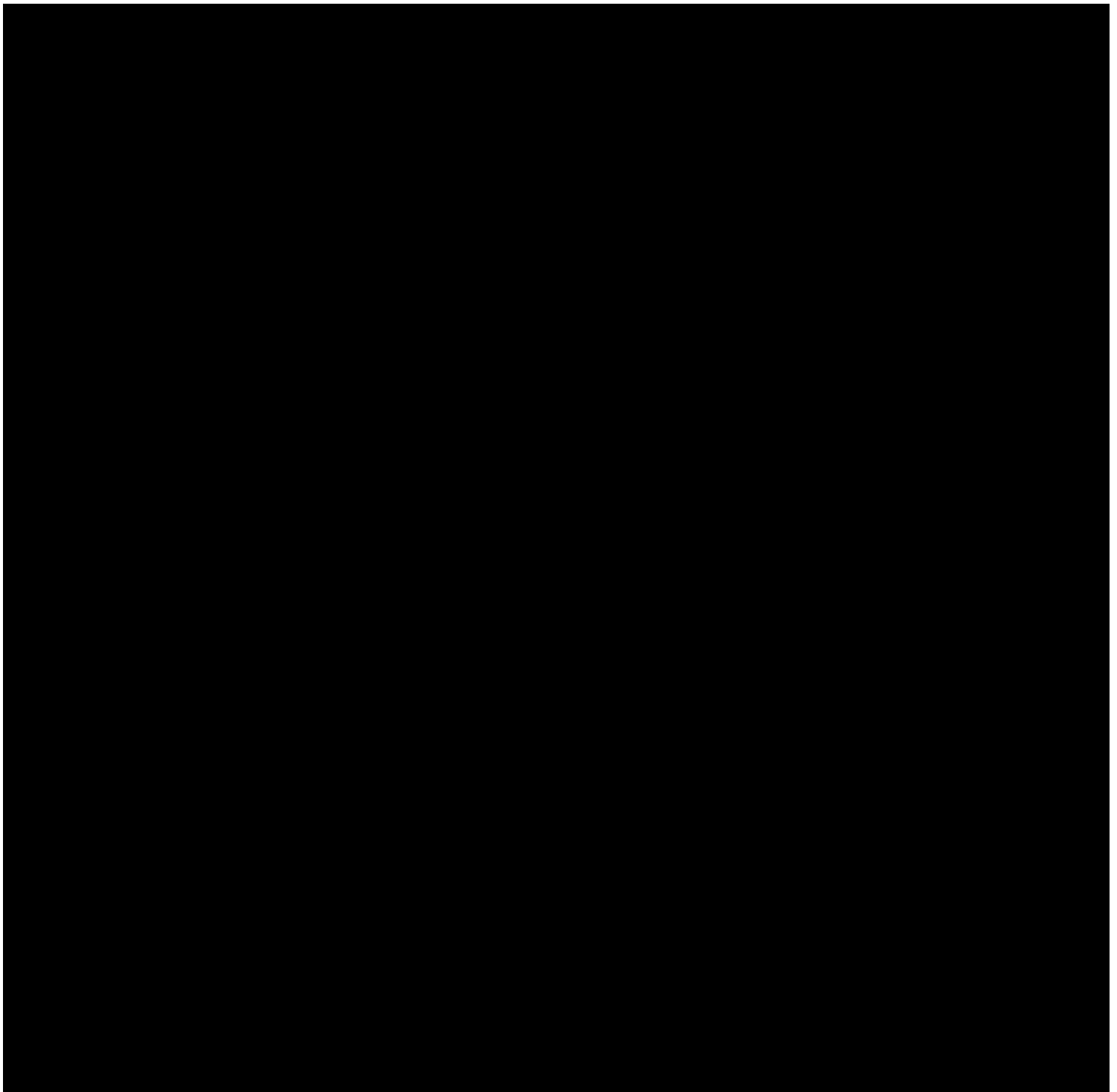
<sup>12</sup> <http://library.rpa.org/interactive/the-triboro/>



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<sup>13</sup> In addition to the RPA proposal, the MTA has initiated a feasibility study of initiating passenger service along the Bay Ridge Branch. As noted in the [press release](#) from January 2020, “The study will evaluate the potential for subway, commuter rail, light rail or bus service that would operate in conjunction with existing and planned freight rail service to help residents travel within Brooklyn and Queens and create a potential for reverse commutation to suburban destinations.”

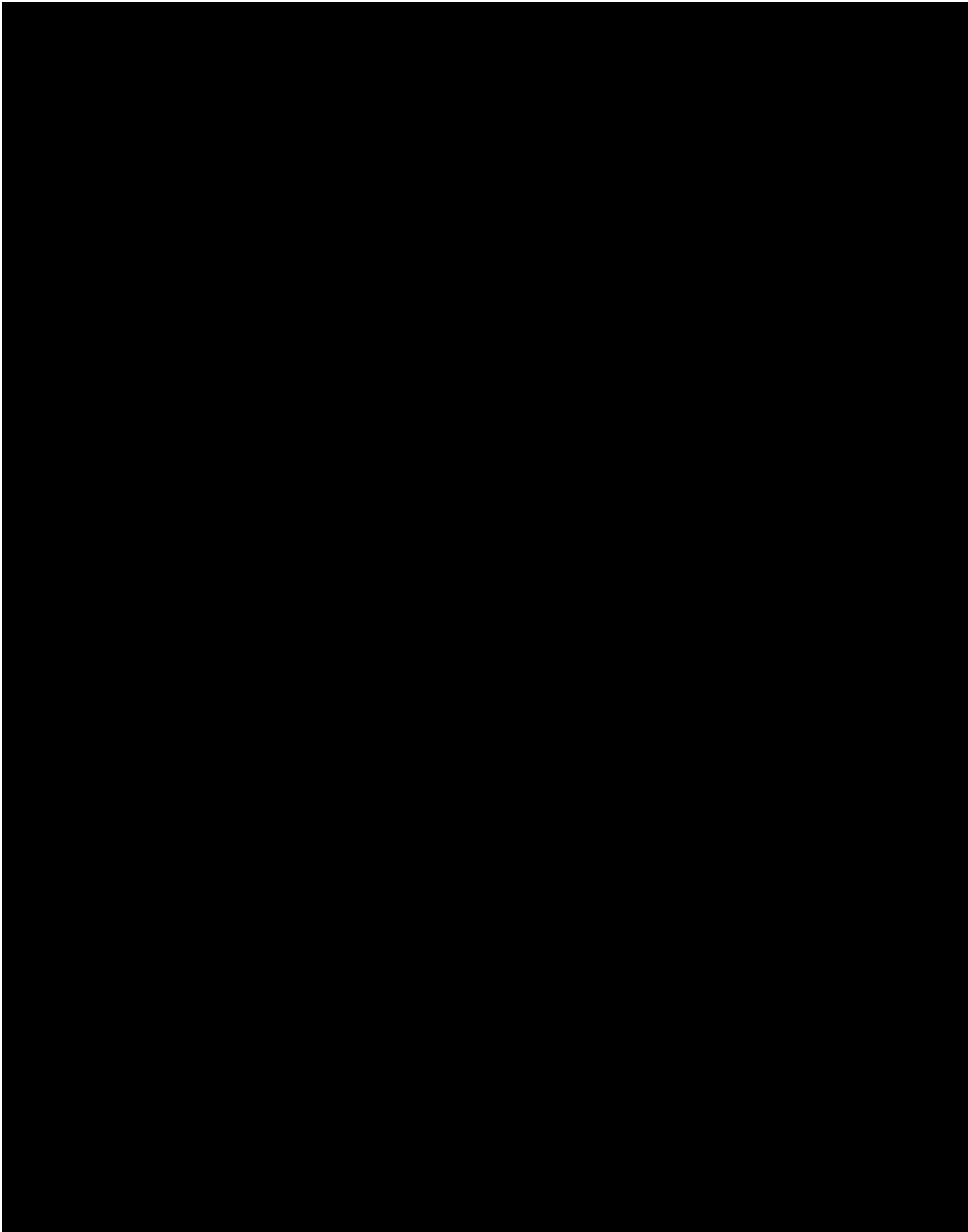
## 6 Additional Alternatives

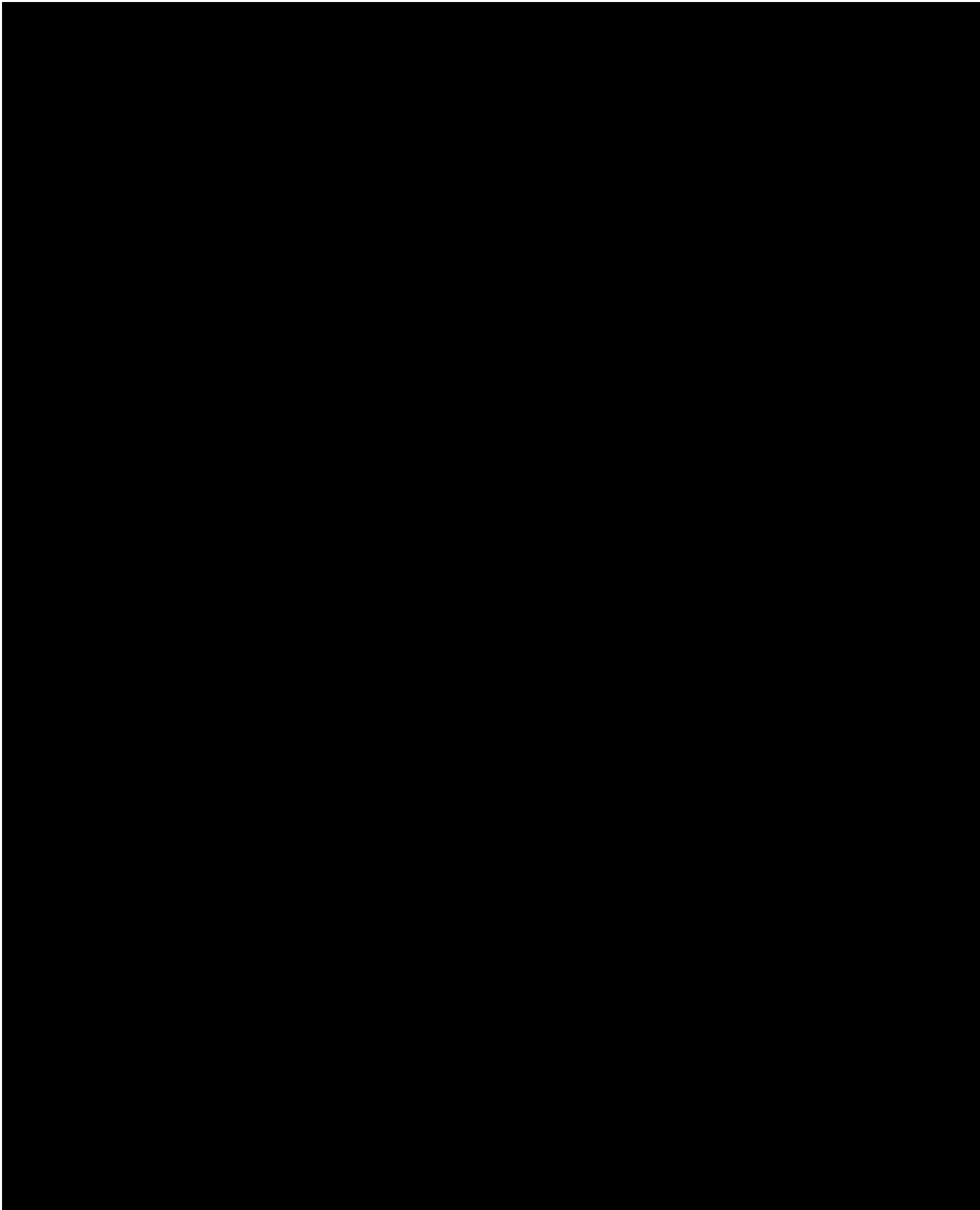


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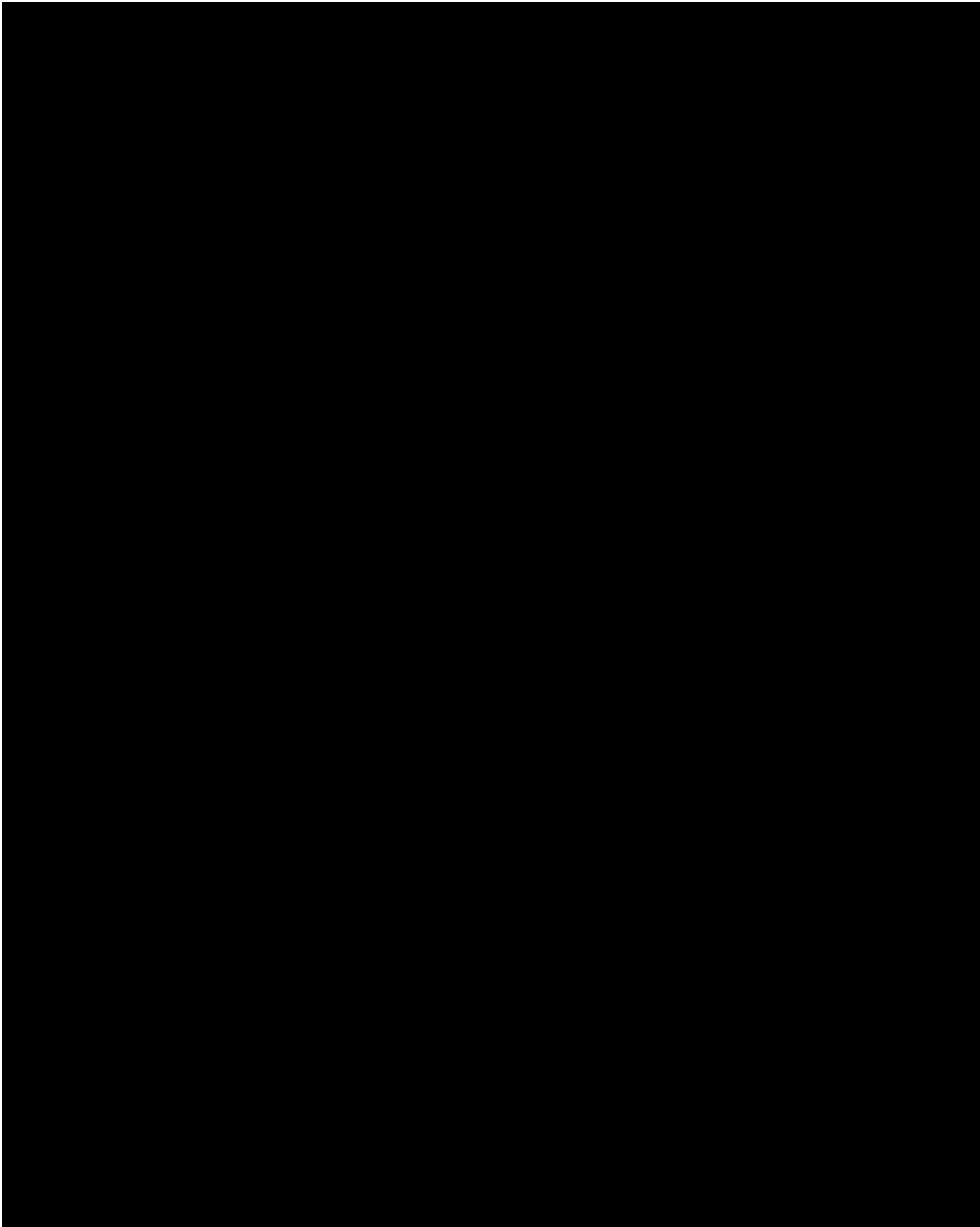
<sup>14</sup> The 2019 NYCT Analysis drawings shown here have been modified to reflect increased lateral clearance requirements as directed by NYCT.



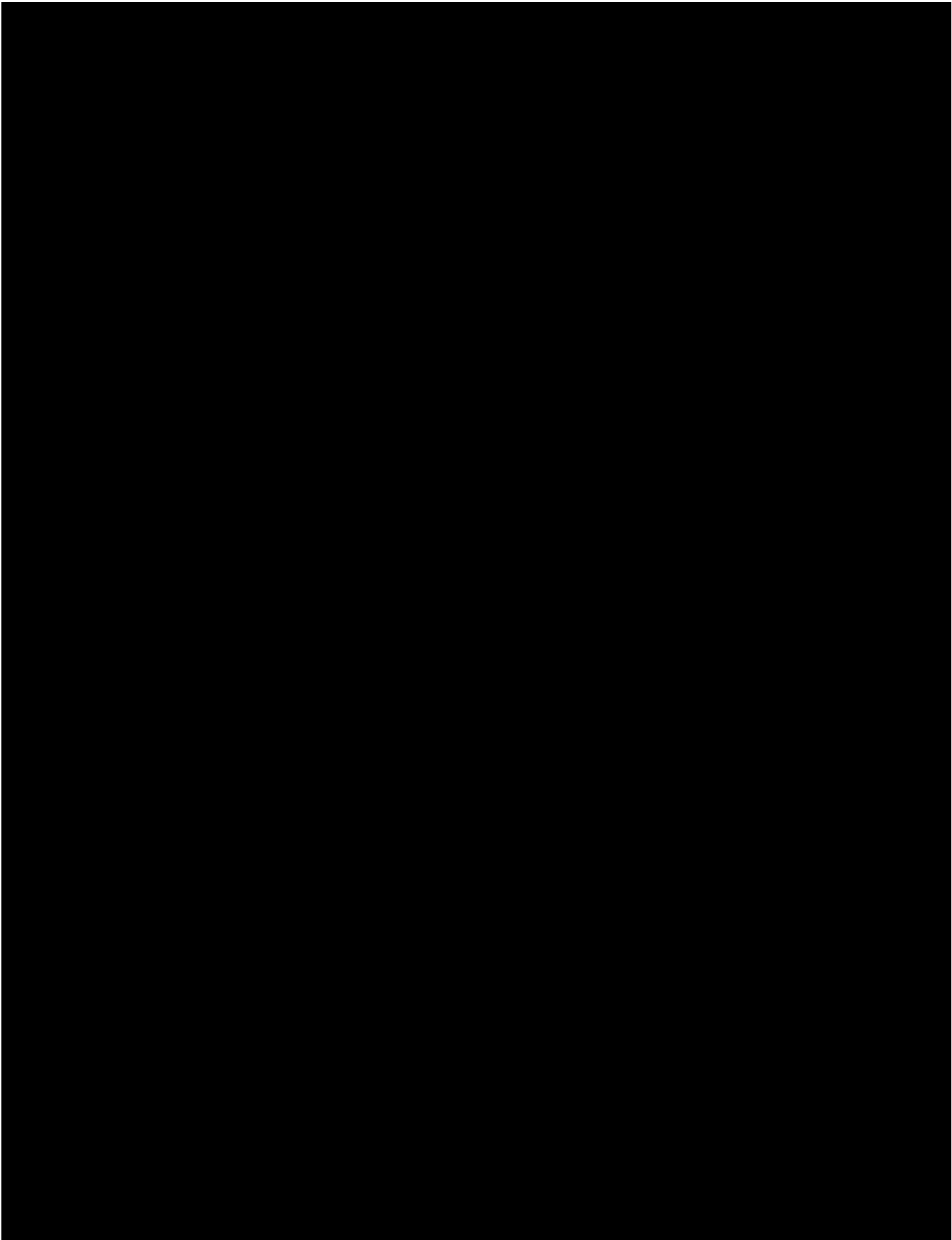


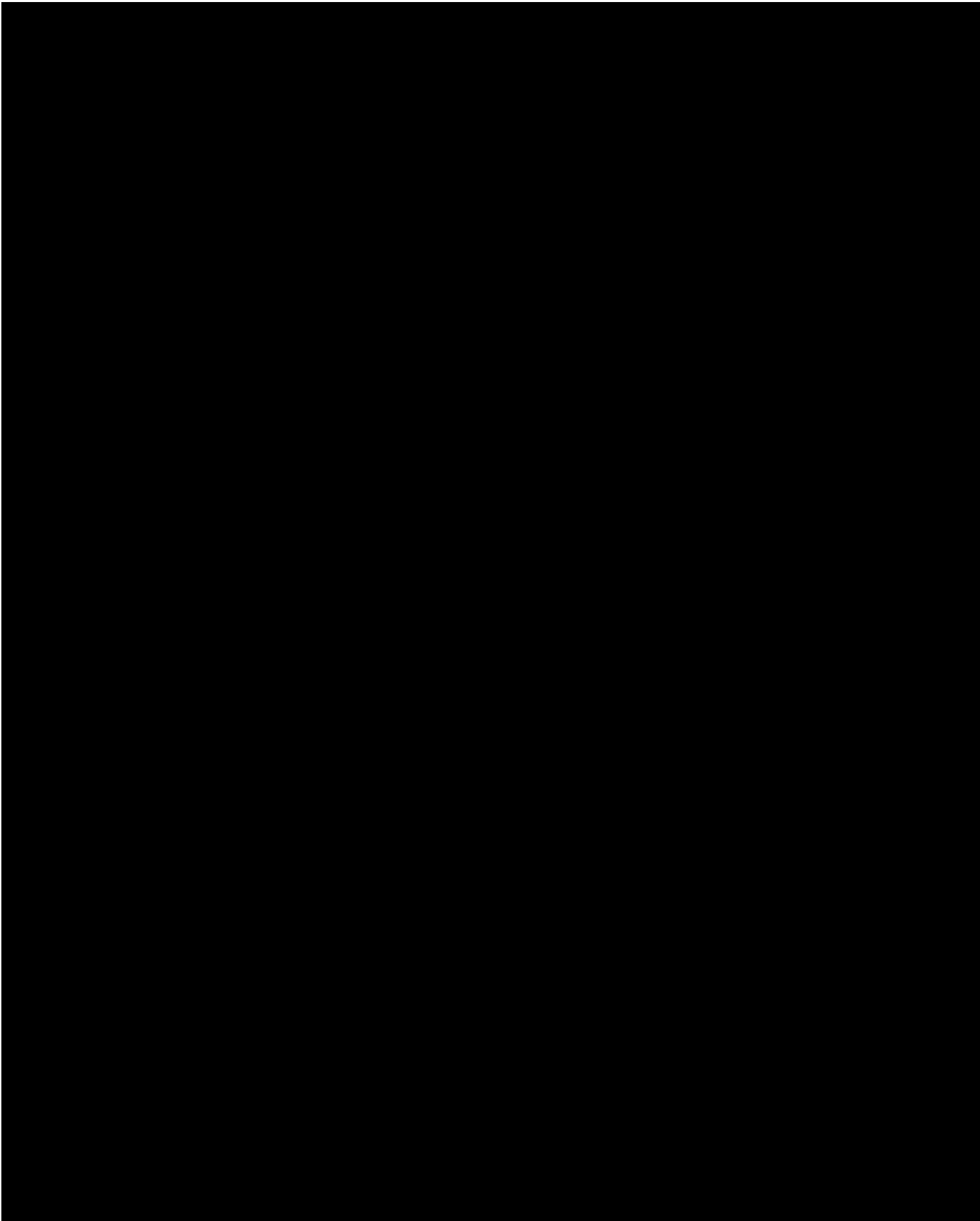


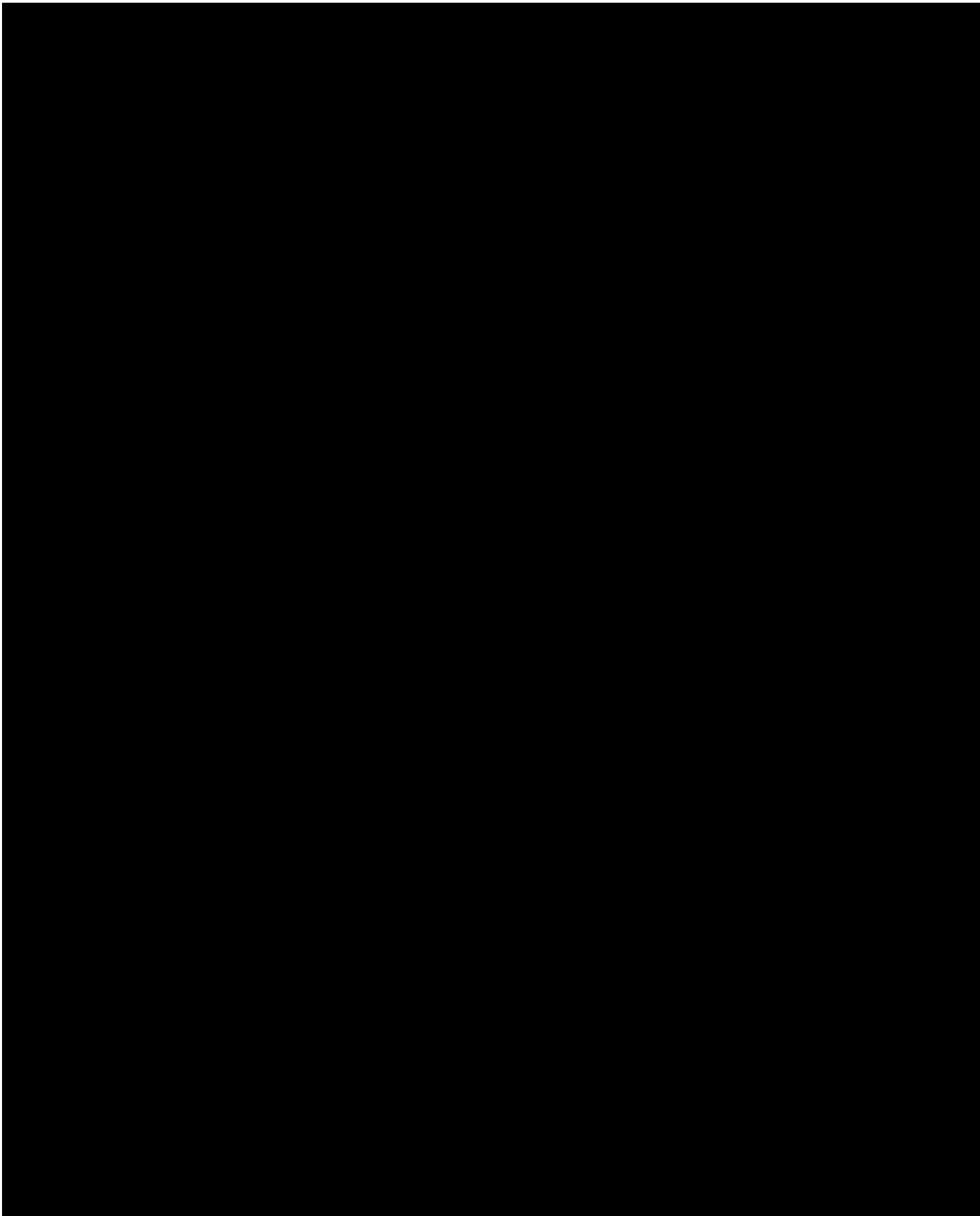




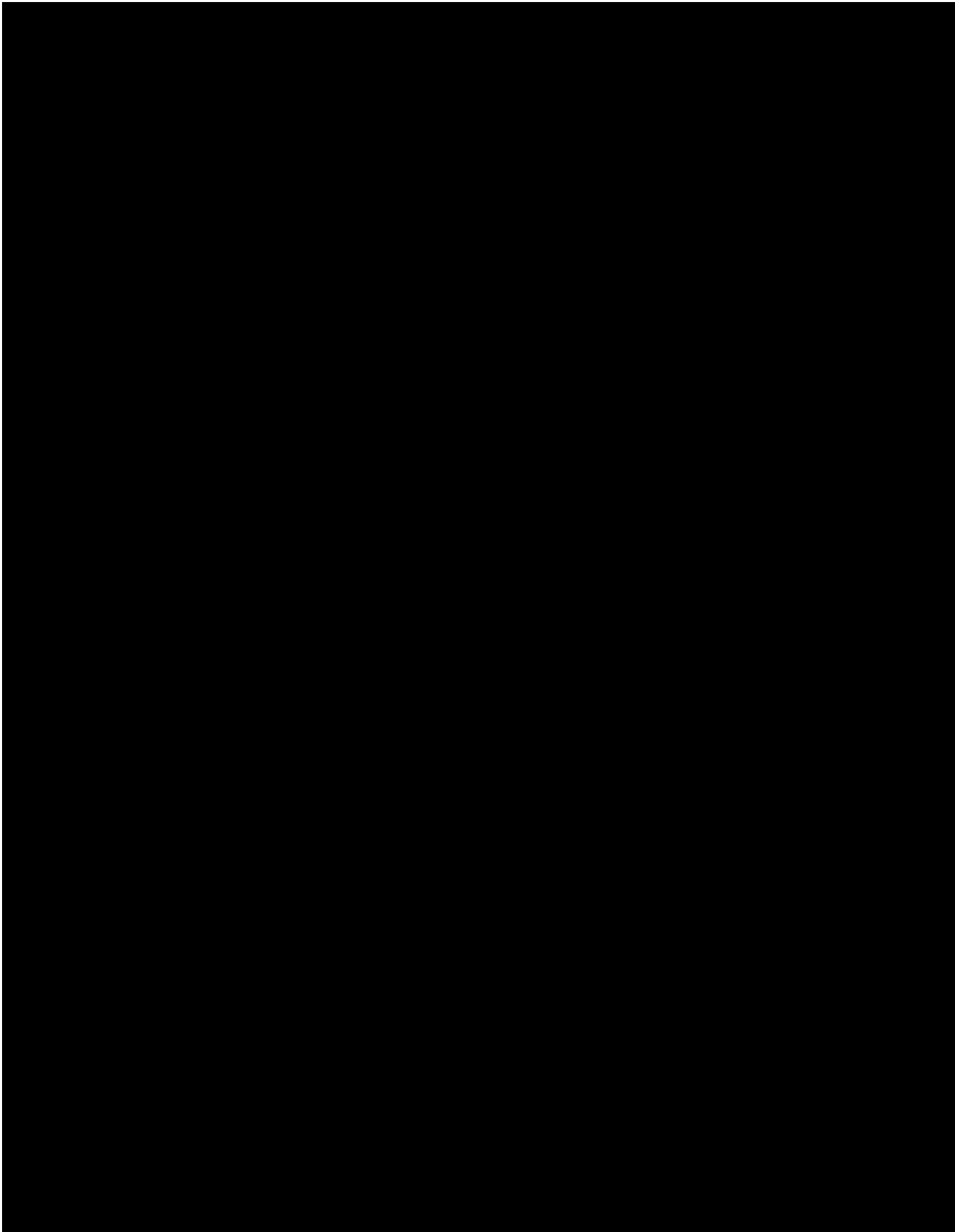


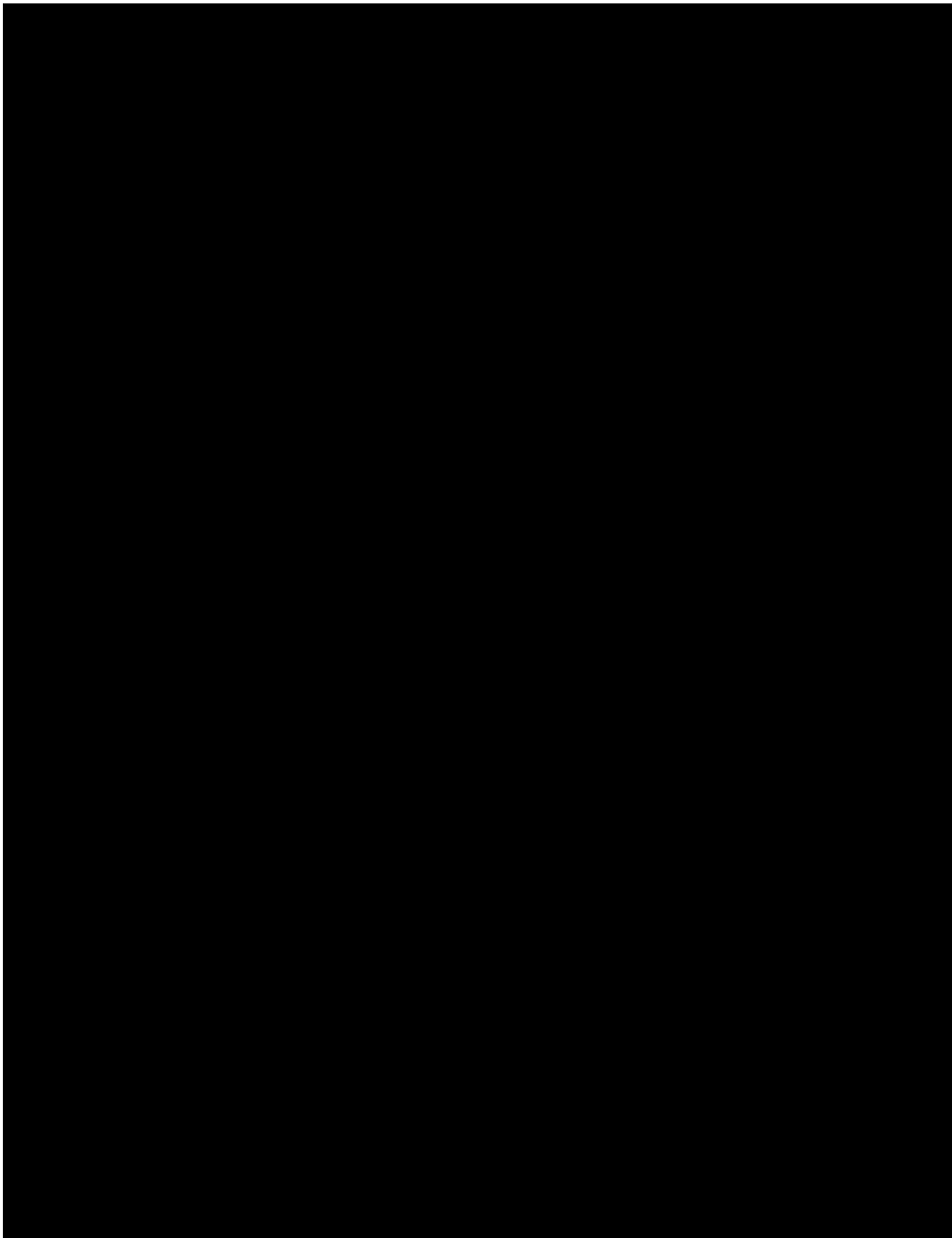


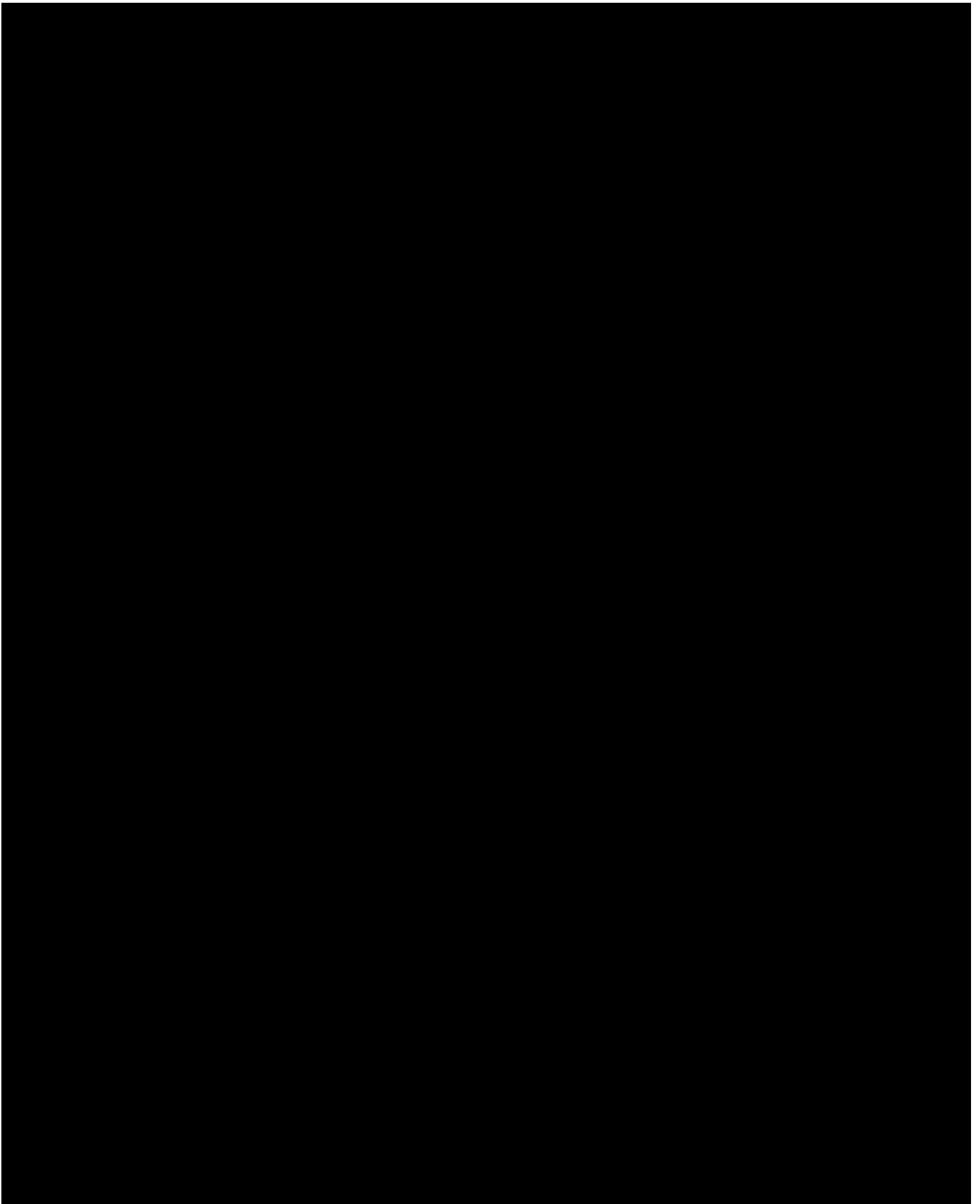


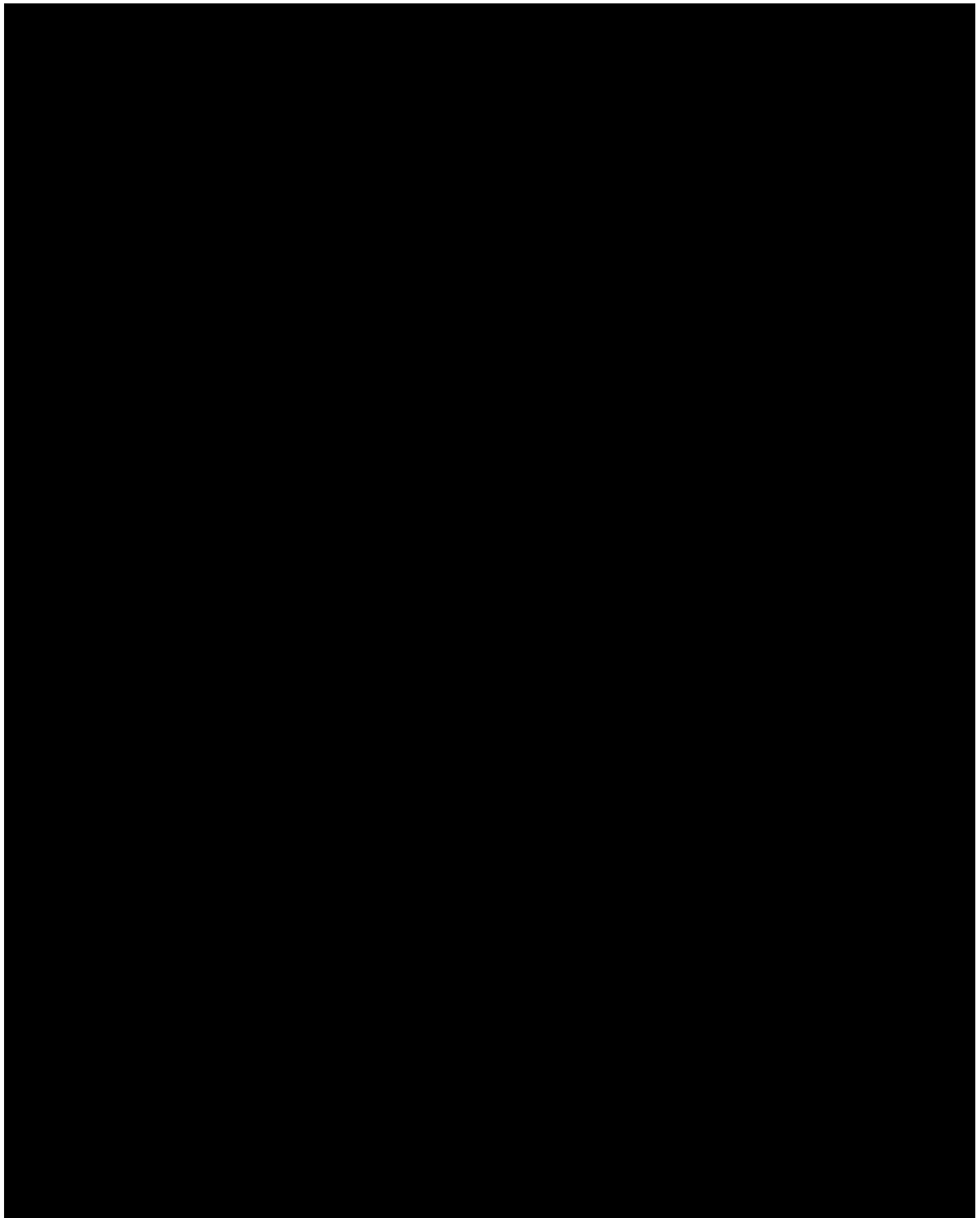


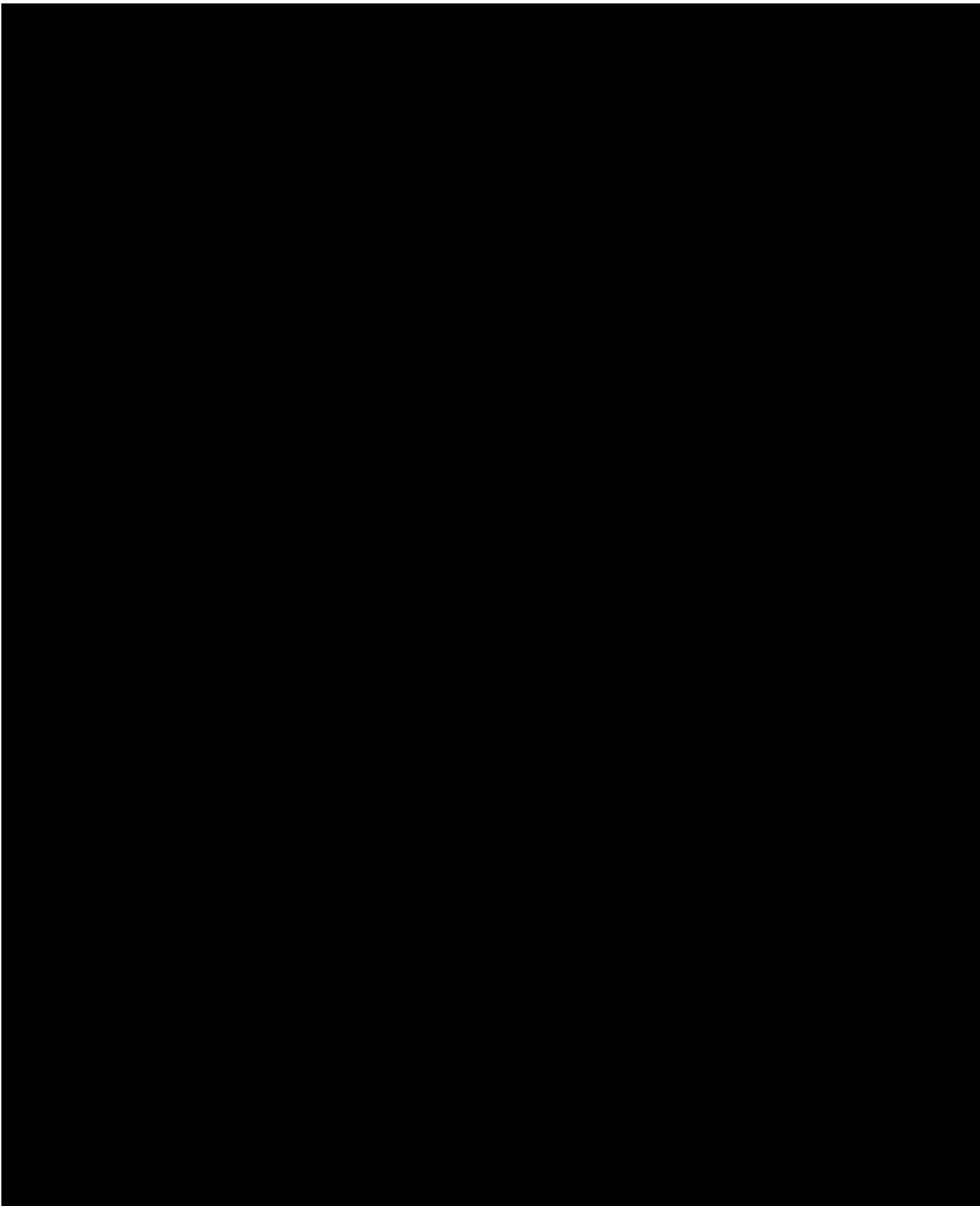


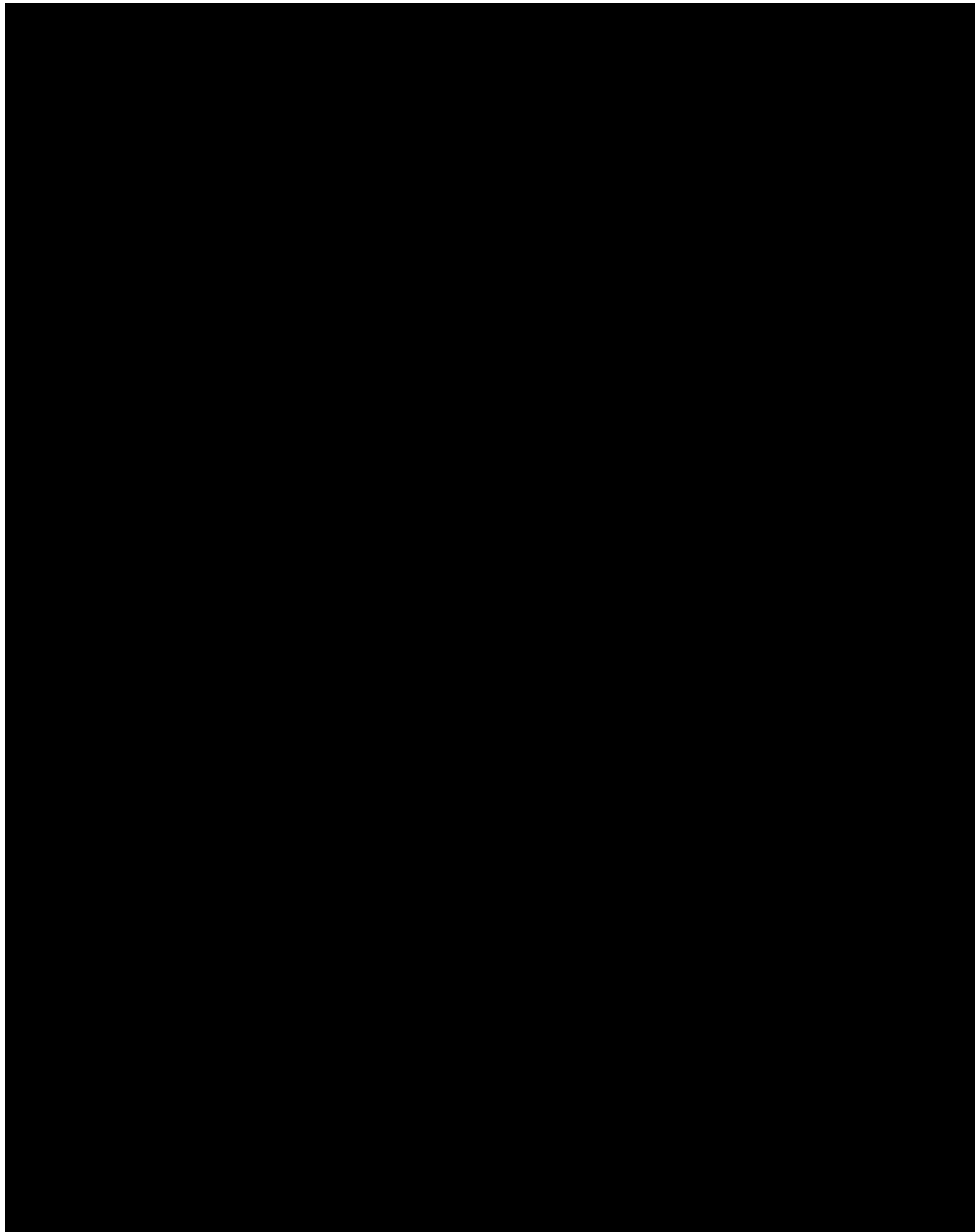






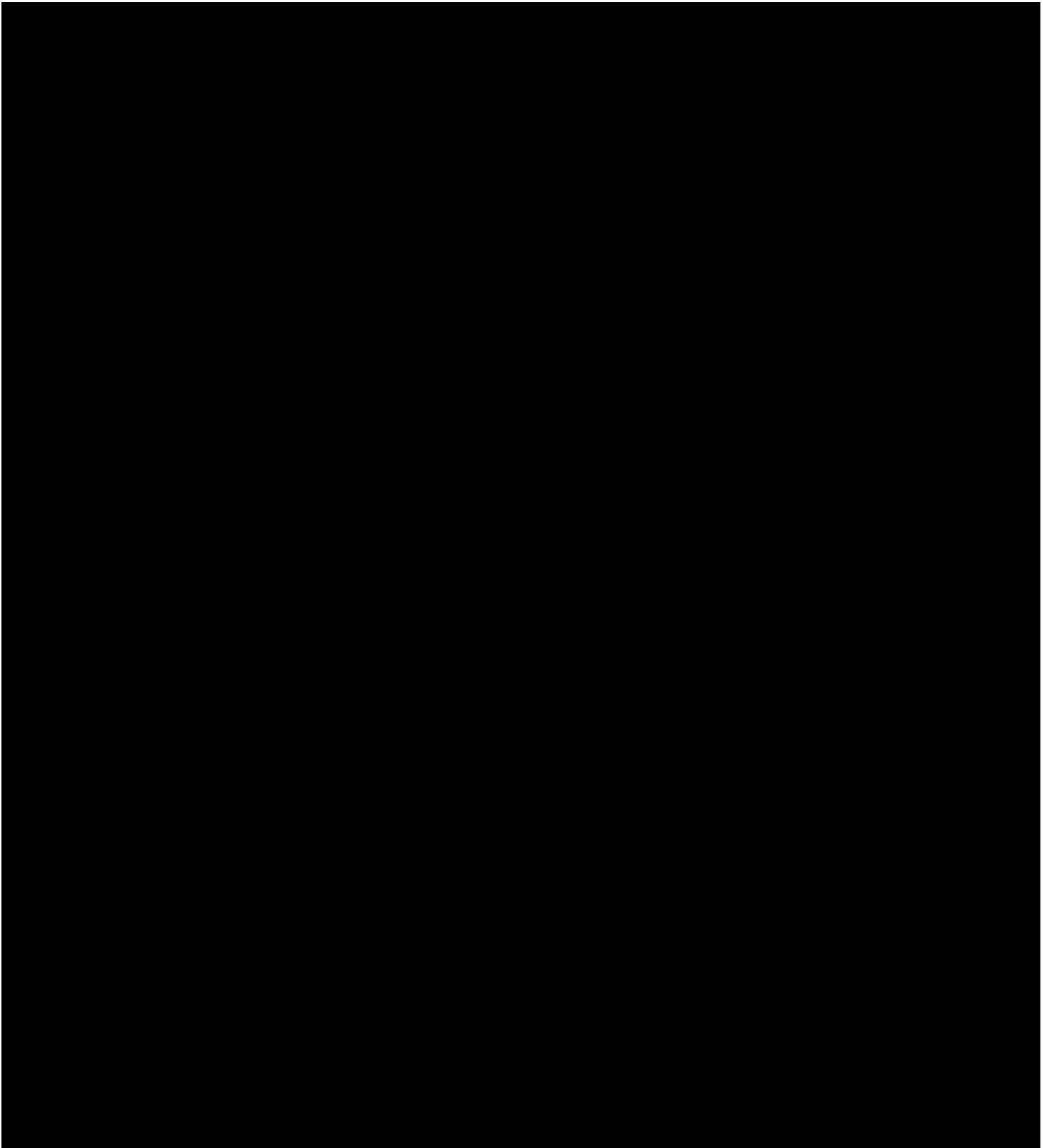




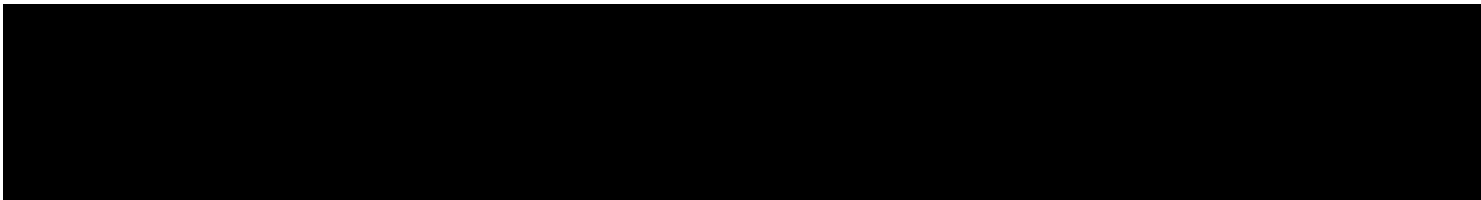
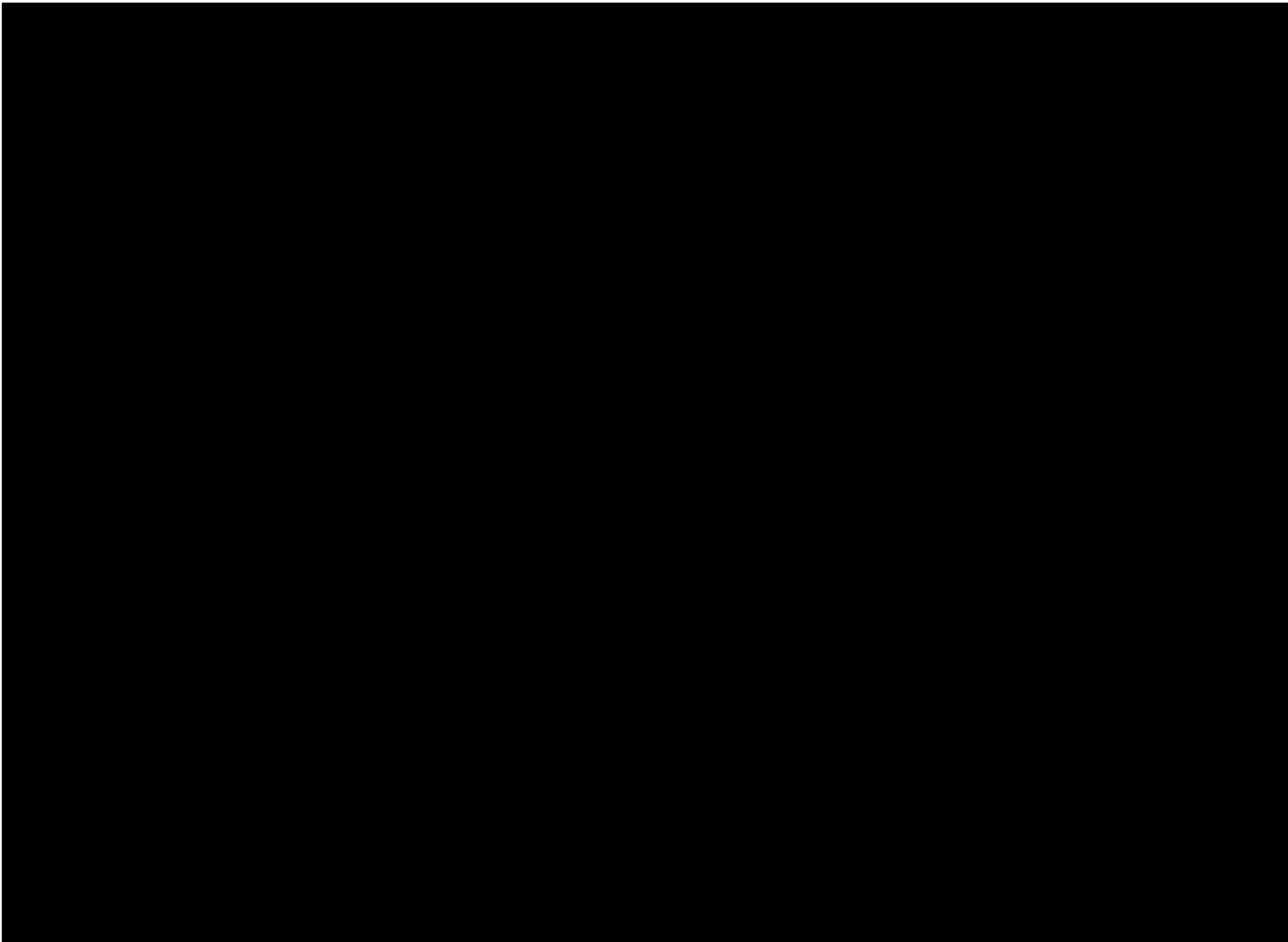




## **7 Preferred Option Recommendation**







## 8 Conclusion

The Utica Avenue Study team concurs with NYCT's proposed two-phased approach to increasing the capacity of Flatbush Av Terminal and providing proximate train storage, allowing operational and storage benefits to be realized incrementally as each phase is funded and constructed. Phase 1 would include the crossover upgrade and overrun track, and Phase 2 would build upon Phase 1 by constructing a new pair of yard lead tracks and a new storage yard.

The construction of the new tail tracks to the storage yard would provide NYCT with flexibility of choice regarding how trains operate into and out of Flatbush Av Terminal to enhance the improvement in line capacity resulting from the No-Build implementation of CBTC on the A-Division. One such choice would be that instead of requiring trains from specific routes to berth at specific platforms, the southbound platform could accept any service, which would improve operational flexibility. The tail tracks would offer new train turnback capacity over the existing station configuration.

In advancing the infrastructure improvements at Flatbush Av Terminal as part of the Utica Avenue Study, the study team simulated train operations to quantify the improvements, which was the subject of a separate Task 2 deliverable.<sup>19</sup> As a subsequent step in this study, the Study Team will determine—in coordination with NYCT and the Steering Committee—whether the recommendations contained herein should be included in the Final Investment Packages in Task 5 (including consideration for transit improvements along Utica Ave). Regardless of whether the improvements are included in the Final Investment Packages, they still have independent utility and can be advanced by NYCT beyond this study.

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<sup>19</sup> It was decided during the 12/2/19 Transit Operations & Rail Simulation Working Group meeting that the Task 2 simulations for the Utica Ave Study would only include the crossover replacement (i.e., Phase 1A) and not the overrun tracks (i.e., Phase 1B) because most of the capacity improvements are enabled by the crossover, as demonstrated by targeted micro-simulations. Additionally, as directed by NYCT, Phase 2 was not simulated as part of the Utica Avenue Study.

## Appendix A Glossary of Terms

**A-Division** comprises the original subway lines constructed by the Interborough Rapid Transit Company. A-Division train cars are narrower than those on the B-Division/BMT-IND lines, but both divisions have the same track gauge (standard gauge, 4'-8.5").

**Communications-Based Train Control (CBTC)** is a signaling system that uses telecommunications between the train and the track equipment to keep trains at a safe separation, manage train traffic, and ensure compliance with track speed limits. With CBTC, the exact position of the train is more accurately known than with traditional fixed-block signal systems. Within NYCT, CBTC has been introduced on the Canarsie Line (L train) and the Flushing Line (7 train).

**Crossover** is an interlocking between parallel tracks to enable trains to move from one track to the other.

**Deadhead** is a train that operates without passengers (out of service). Deadhead trains are typically used to move trains from yards to the start of service, to yards at the end of service, or to remove trains from service for scheduled or unscheduled reasons.

**Double-stack** freight trains convey shipping containers on rail cars stacked two high.

**Fixed-block signal system** is a signaling system that divides each track into different fixed-length blocks with a signal at the entrance to the block to govern whether it is safe to enter and occupy that block. This type of signaling system is the most prevalent type within the NYCT subway.

**Interlocking** is a series of turnouts, the operations of which are interlocked so that trains can safely move from one track to another.

**Leader** refers to the train ahead on the same track in the same direction.

**Line** refers to the name of the infrastructure (e.g., Brighton Line).

**Overrun track (also track overrun)** is the length of track providing a safety buffer between the end of a platform and the bumper block.

**Put ins** refers to a non-revenue train entering revenue service.

**Relaying** is the repositioning and reversing of an out-of-service train from one track to another, usually to position it for a revenue trip in the reverse direction.

**Revenue train** is a train that is in passenger service.

**Route** refers to the train services that operate over a line (e.g., B and Q trains operate over the Brighton Line).

**Storage Yard** is a set of tracks where trains are stored either during the middays and/or overnight hours.

**Tail tracks** are non-revenue (no passengers allowed) tracks where subway trains are either stored, or turned back.

**Trainset** is a set of subway train cars semi-permanently coupled together to form the full consist of a revenue service train.

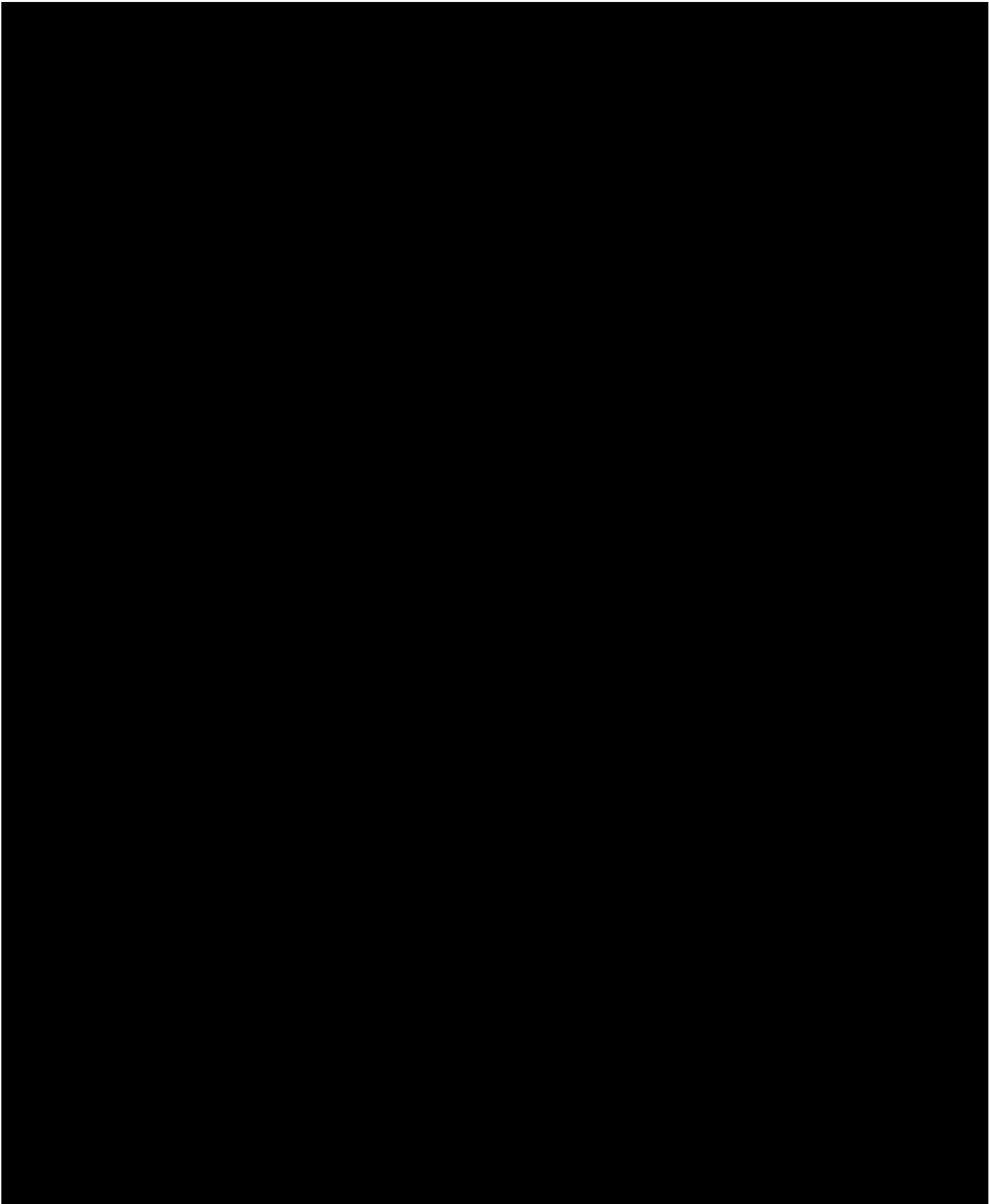
**Turnback** is when a train changes the direction of travel, such as when a southbound train becomes a northbound train.

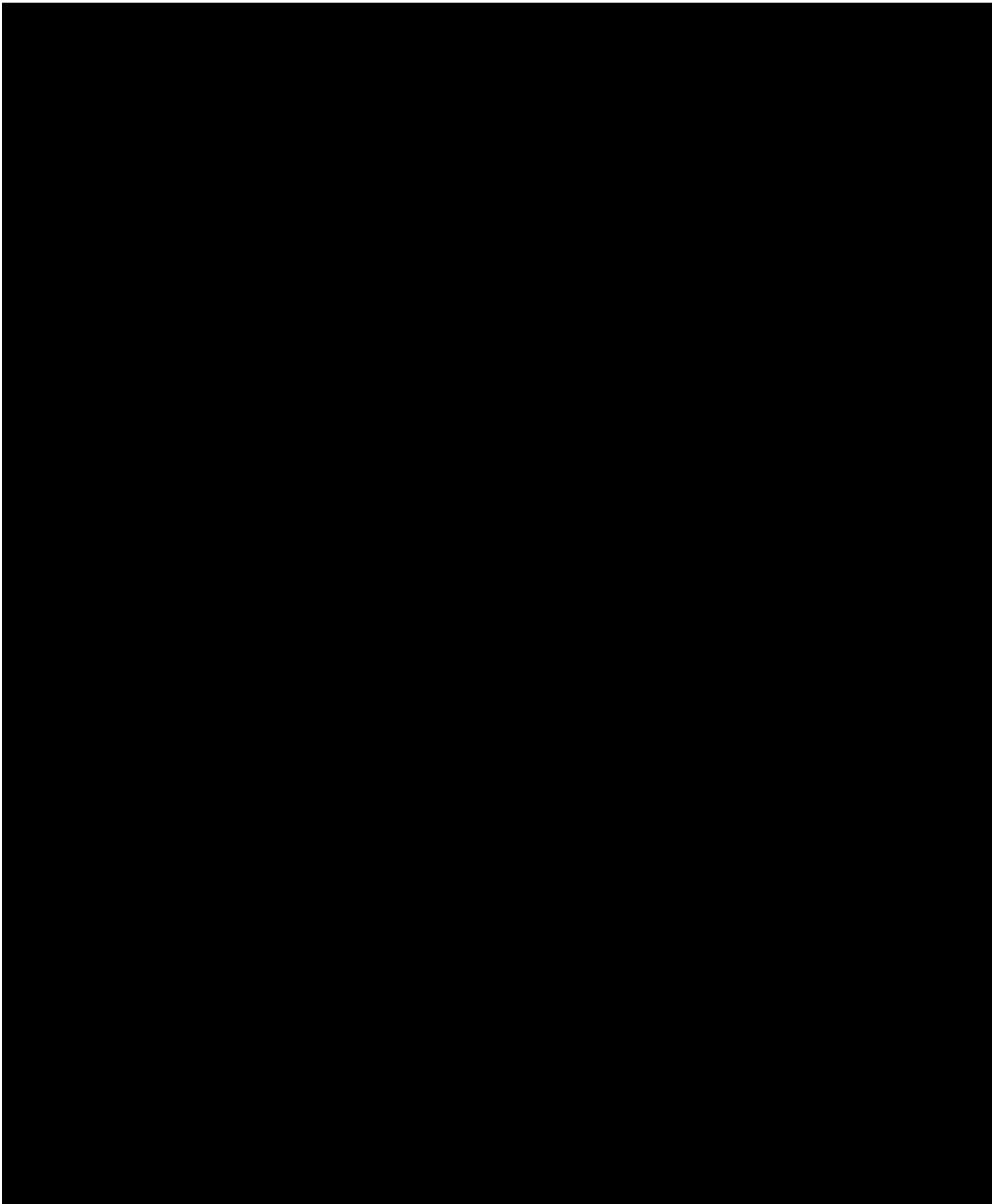
**Turnout** is a special track installation used to allow trains to proceed straight ahead or to diverge to another track.

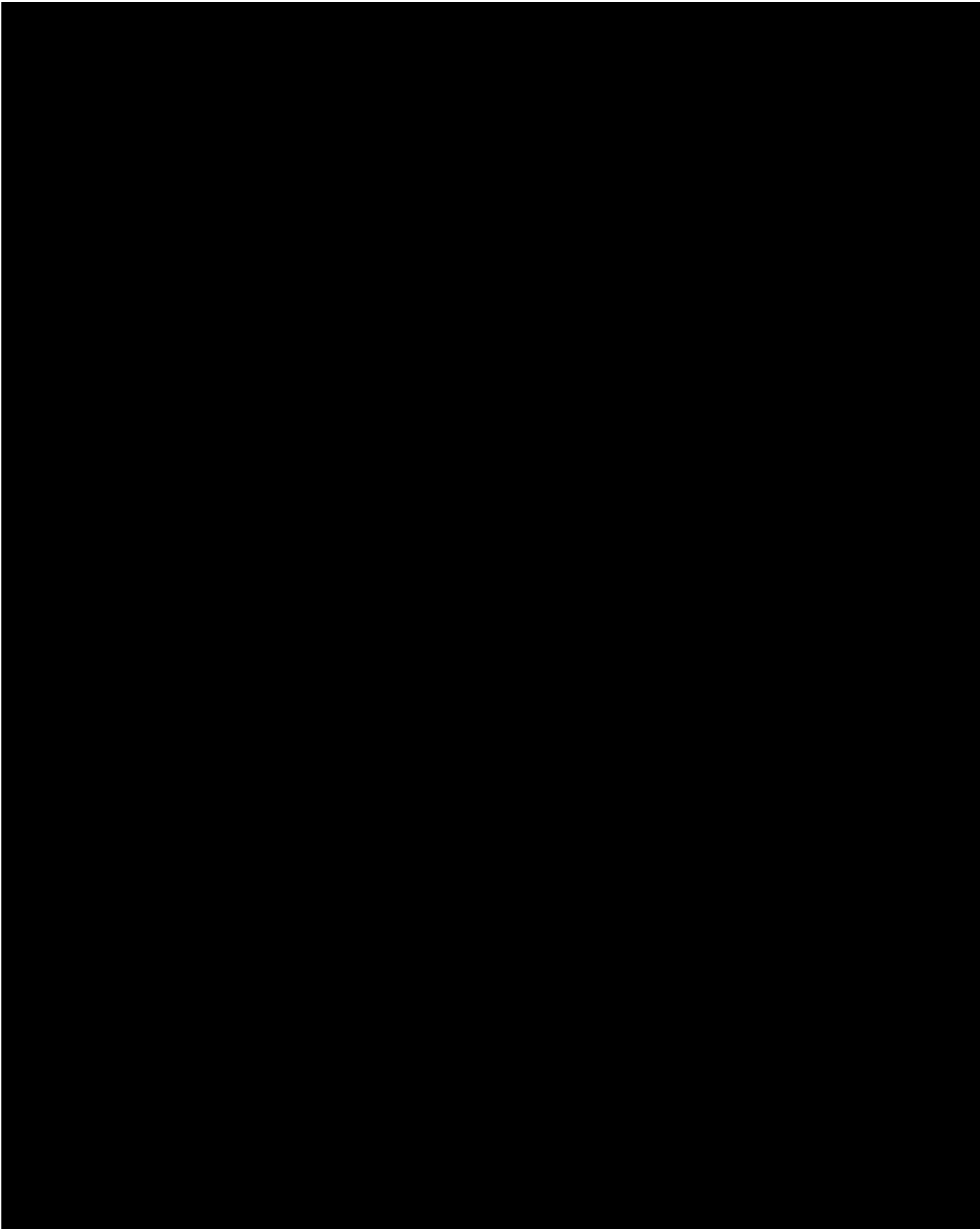
**Turnout Number (#XX)** is the classification of a turnout by the inclination of the rail crossing contained in the turnout. Higher turnout numbers correspond to lower crossing angles and hence higher speeds are permitted over that turnout. For example, a #10 turnout will permit trains to operate at a faster speed than a #6 turnout. Higher turnout numbers also correspond to longer turnout footprint length. A #10 turnout occupies a longer footprint than a #6 turnout.

**Yard lead tracks** are those tracks that connect revenue service tracks to a yard.

## **Appendix B      Construction Duration and Capital Cost Estimate**





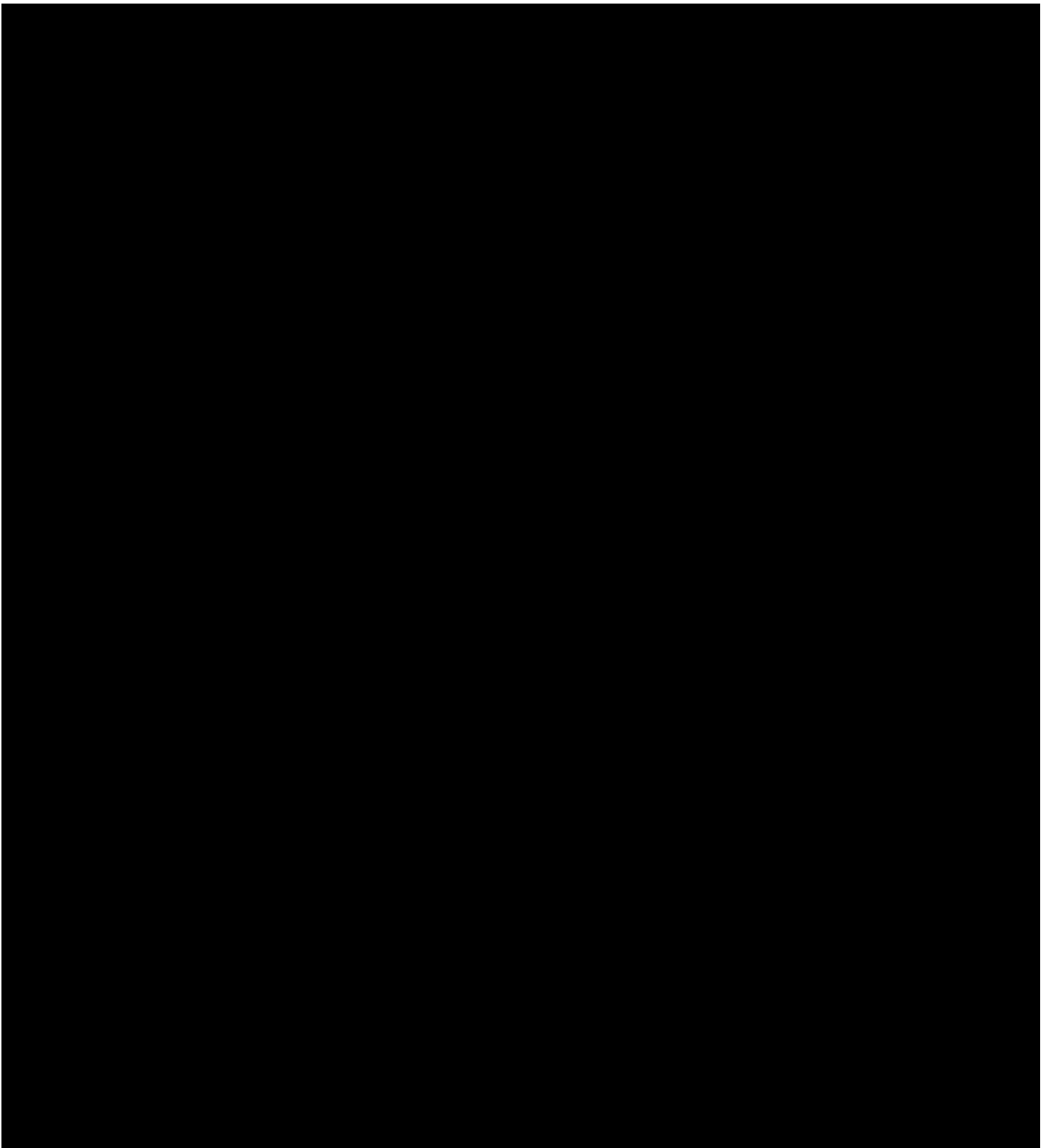


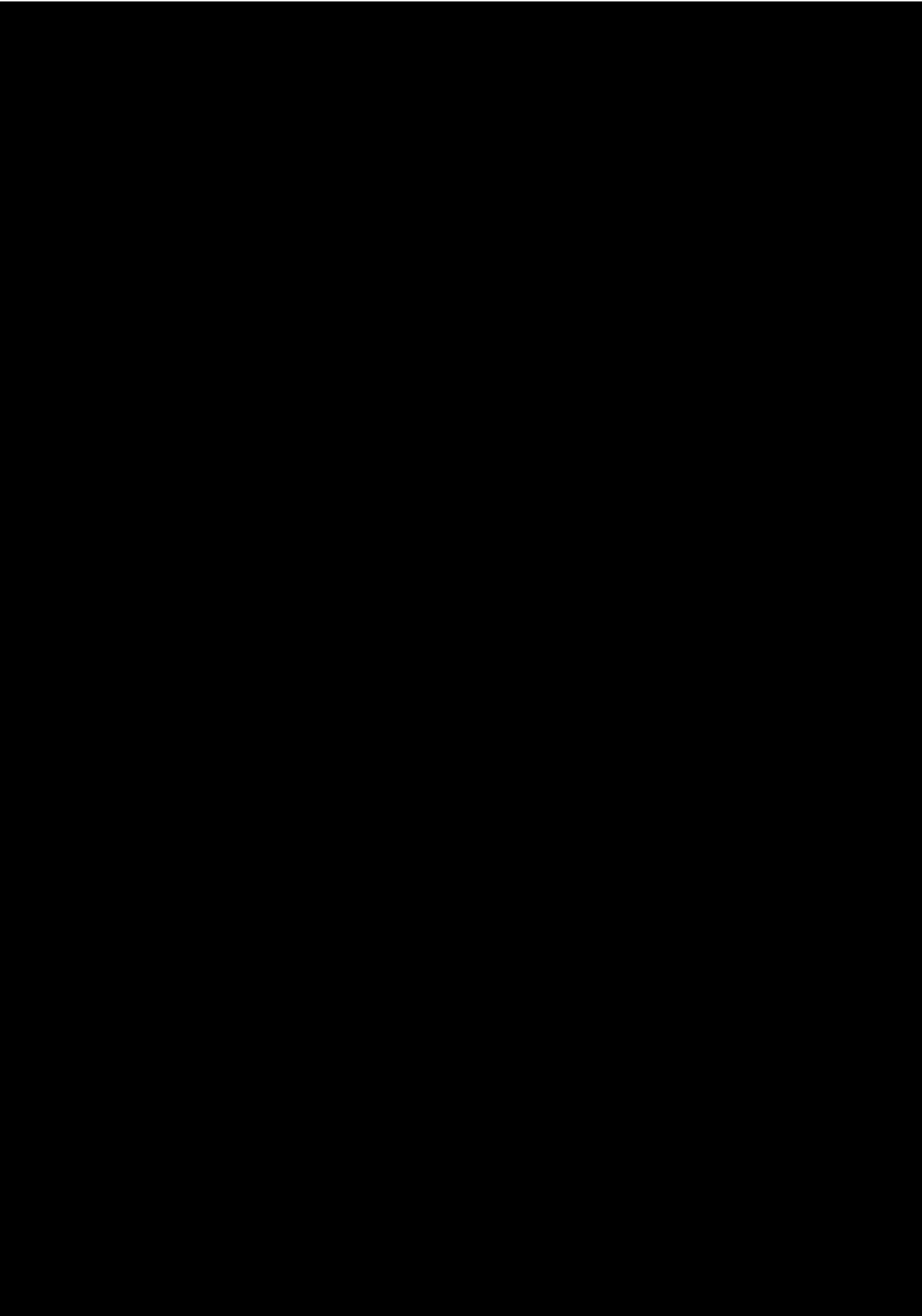


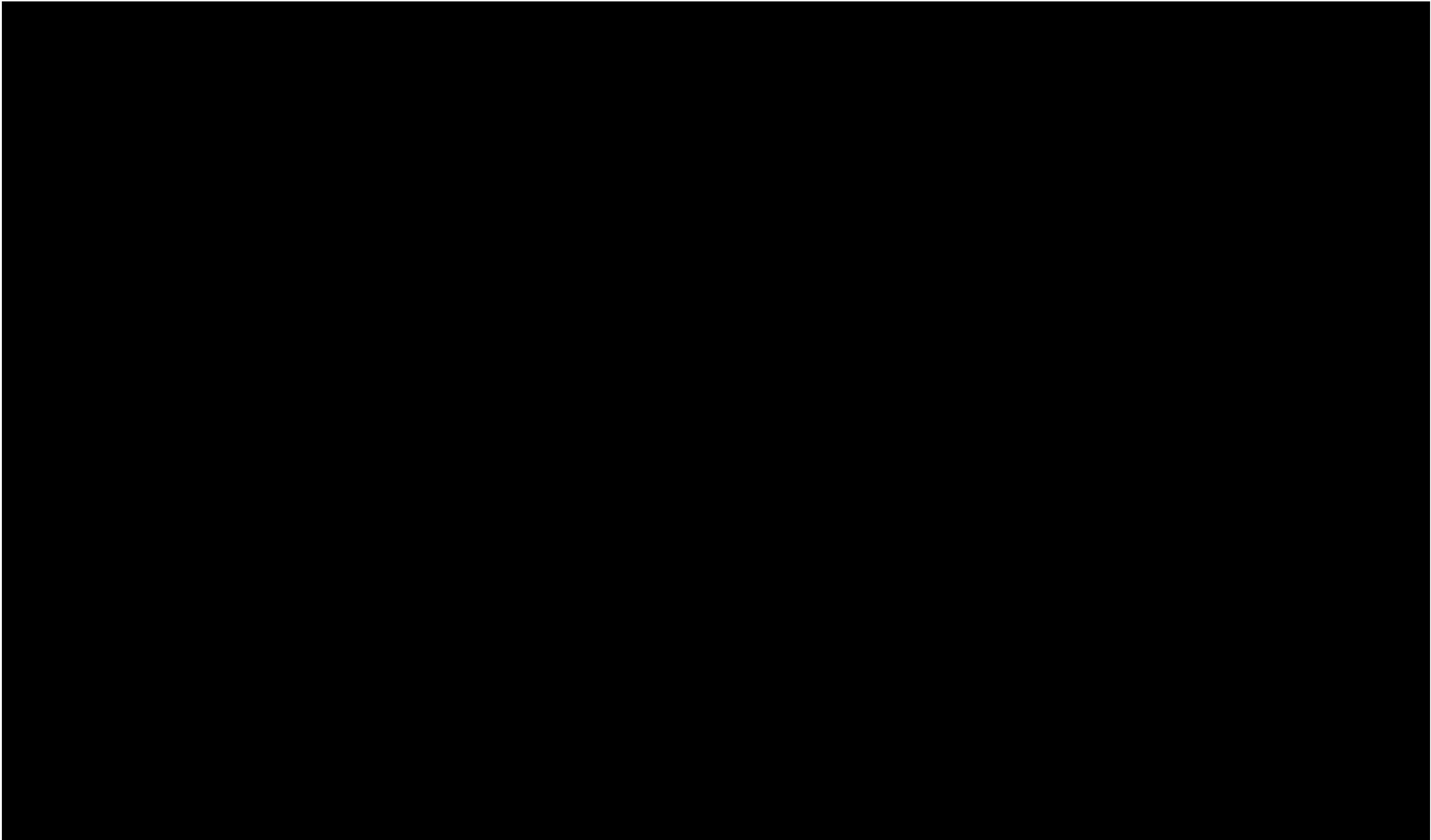


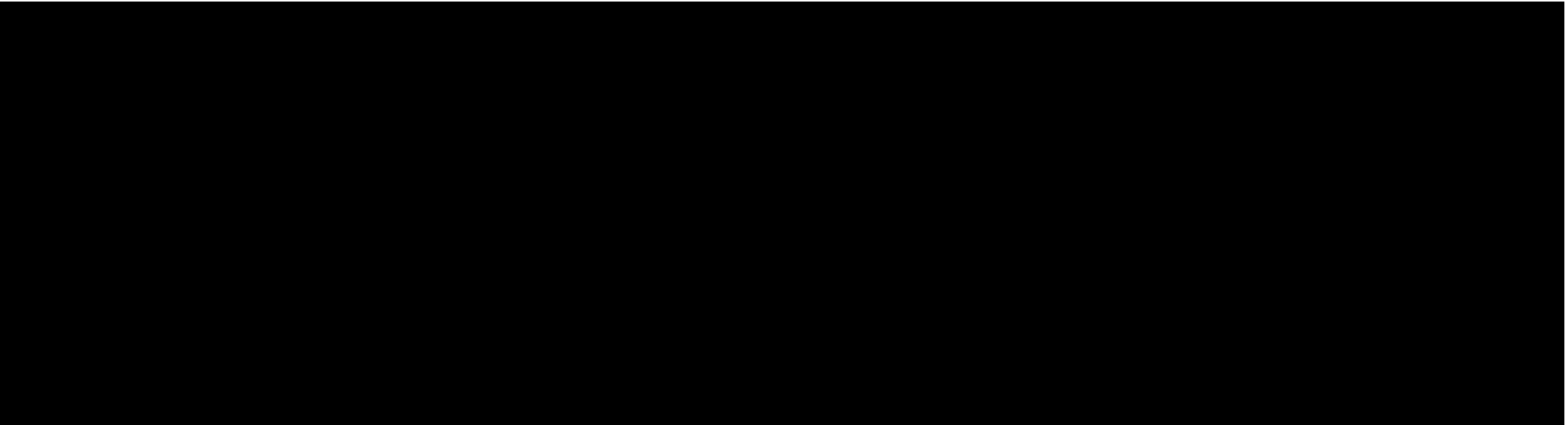


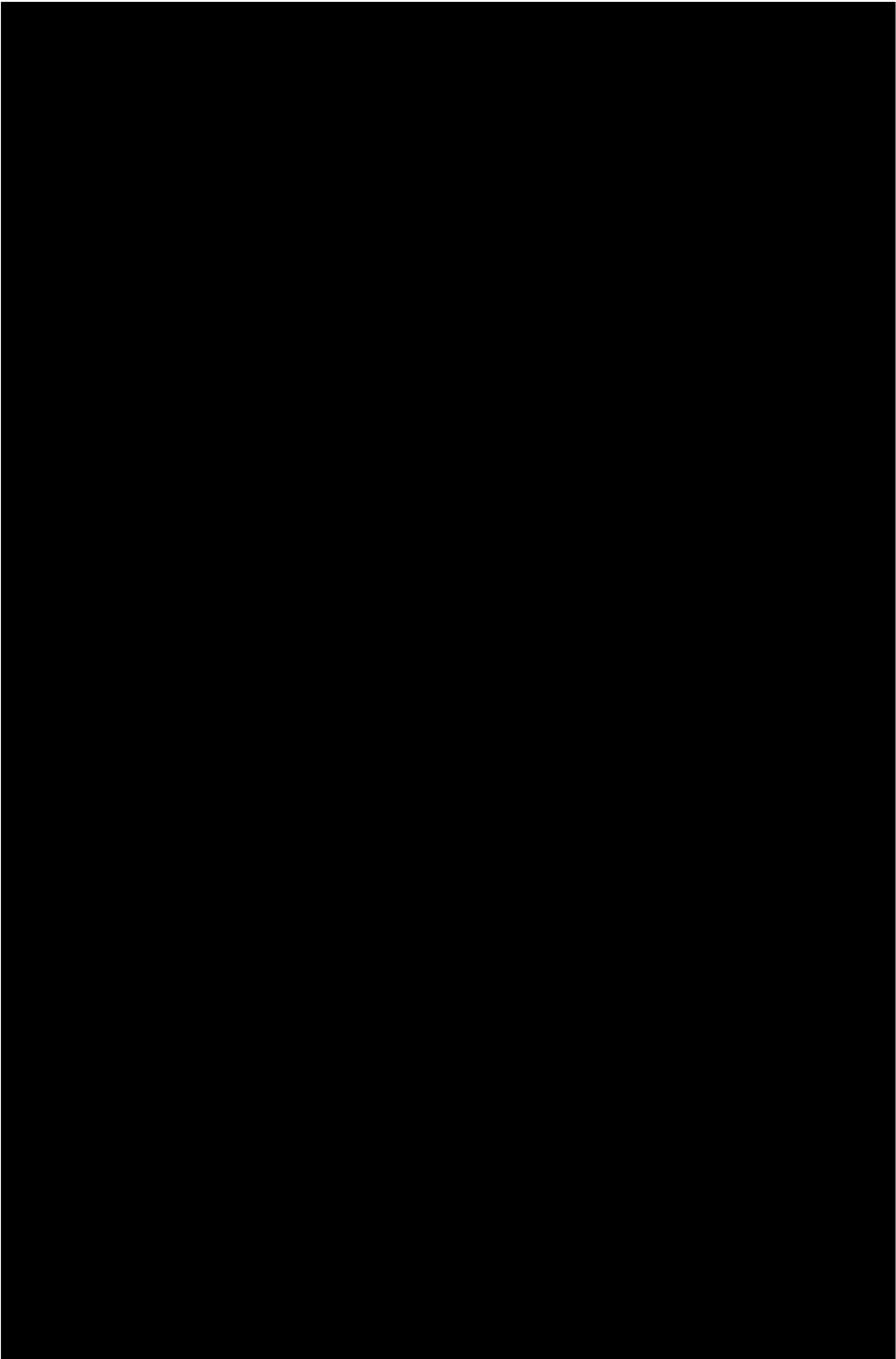






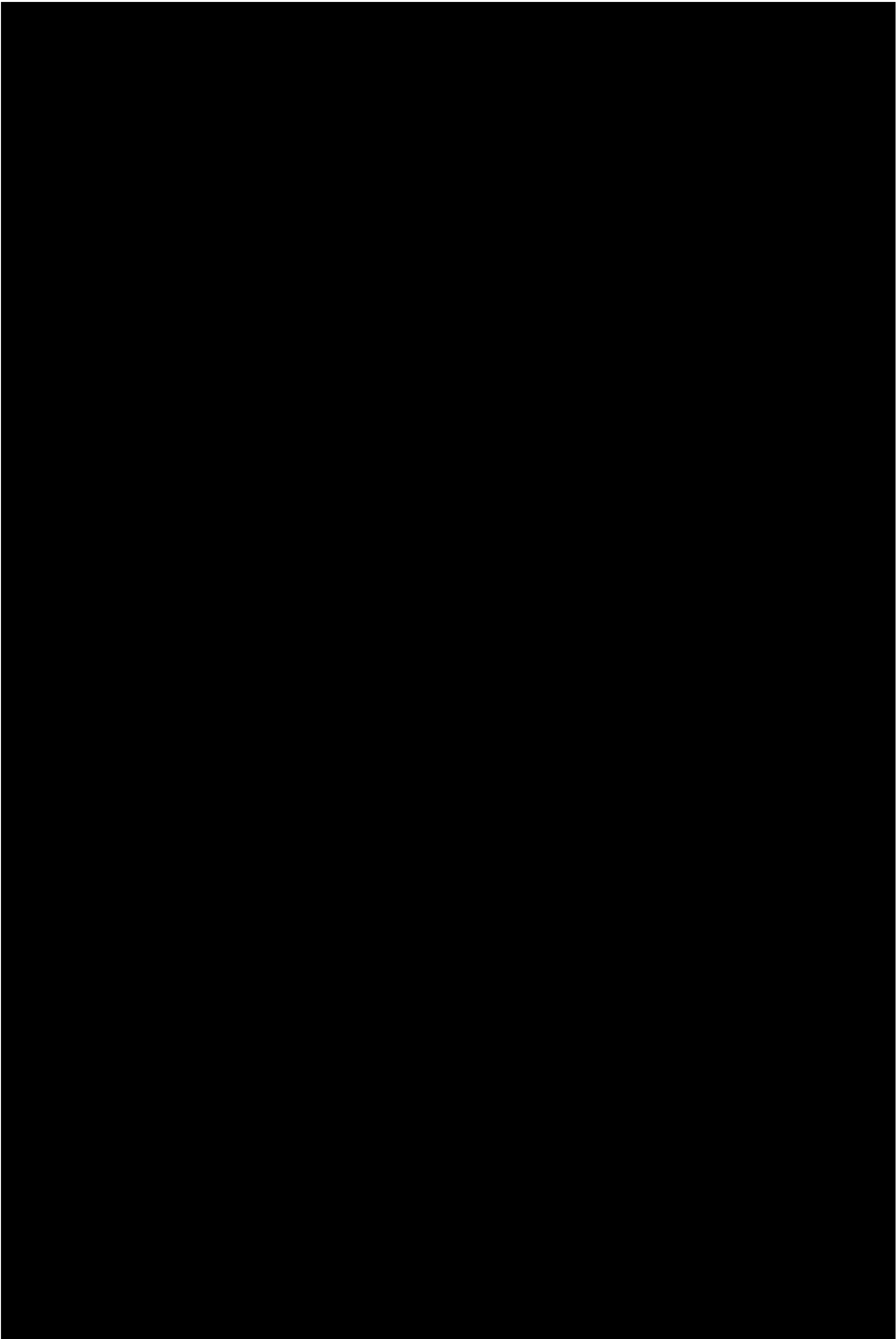


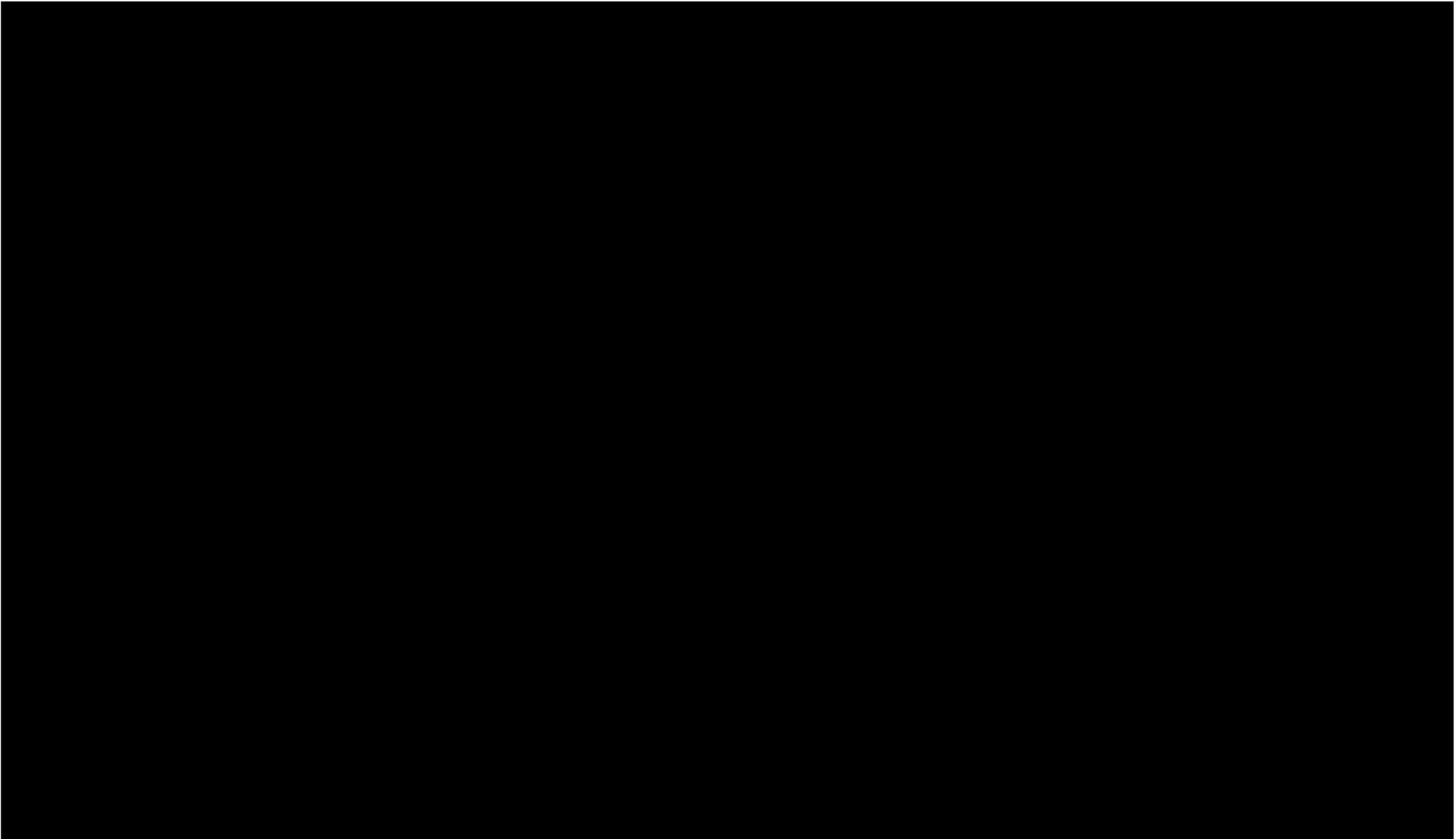


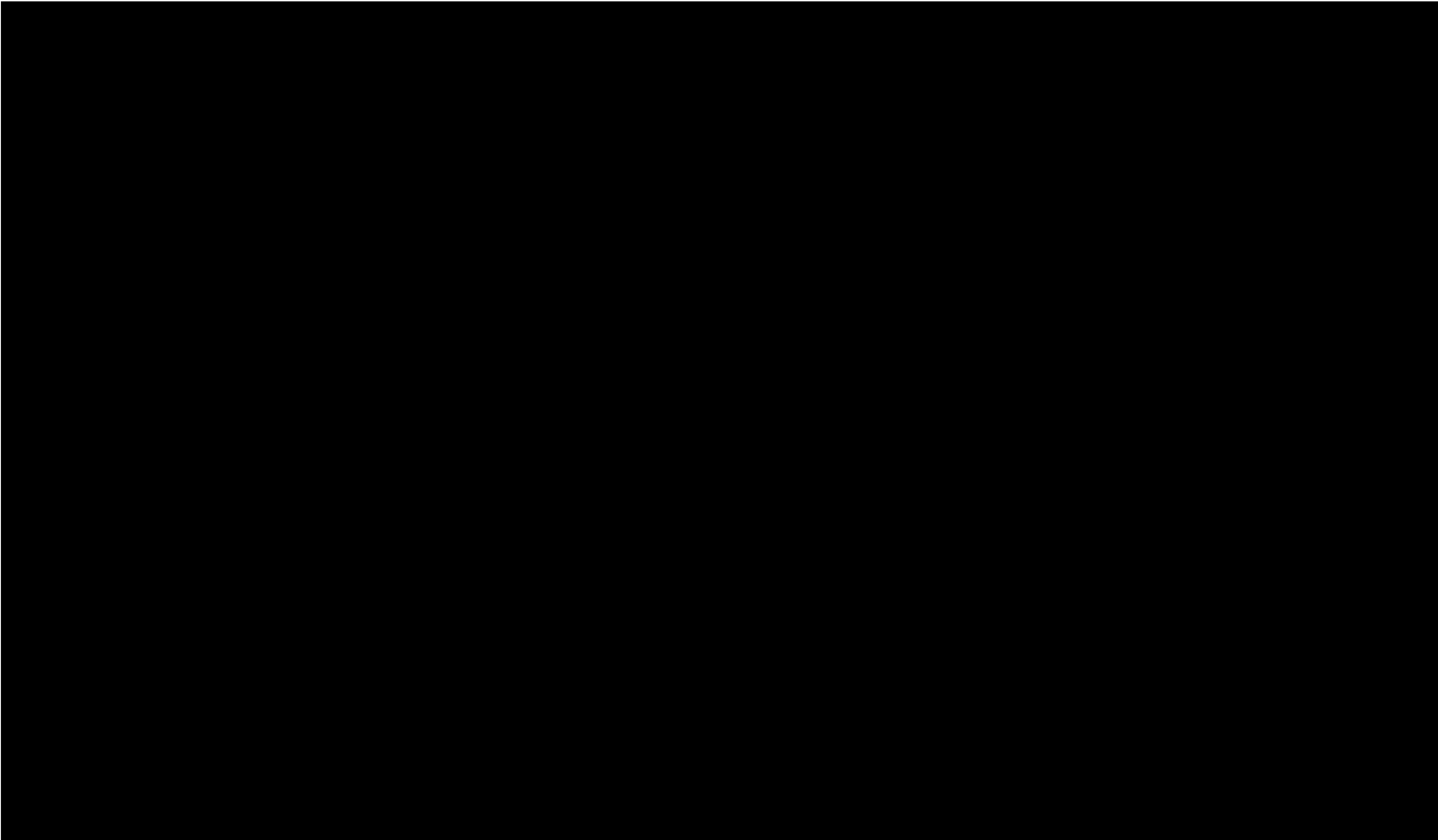


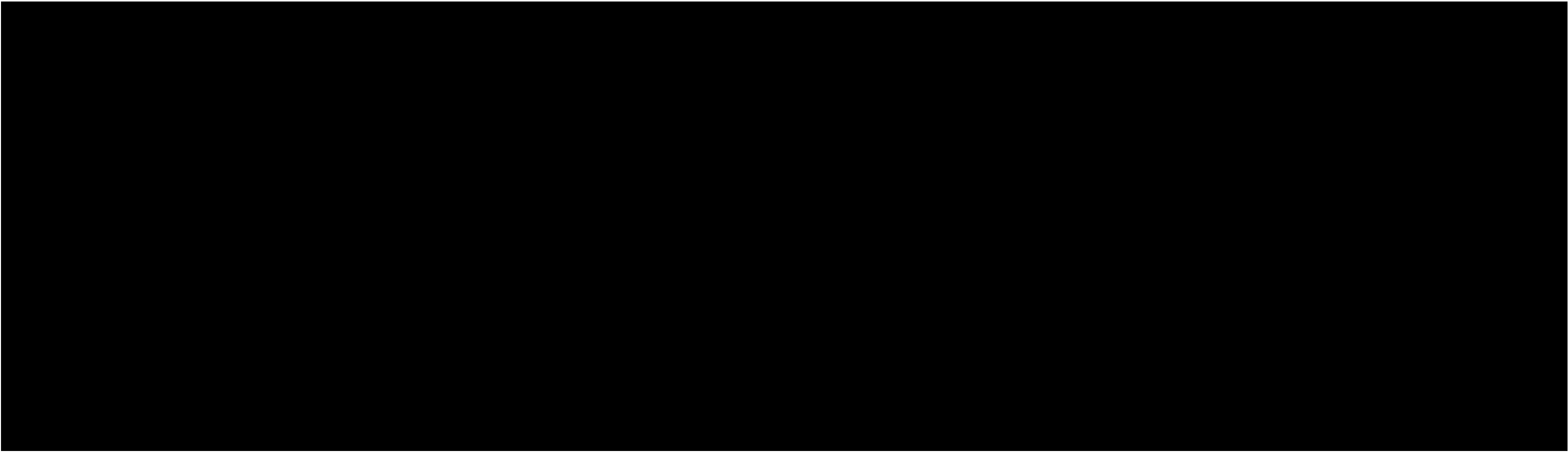


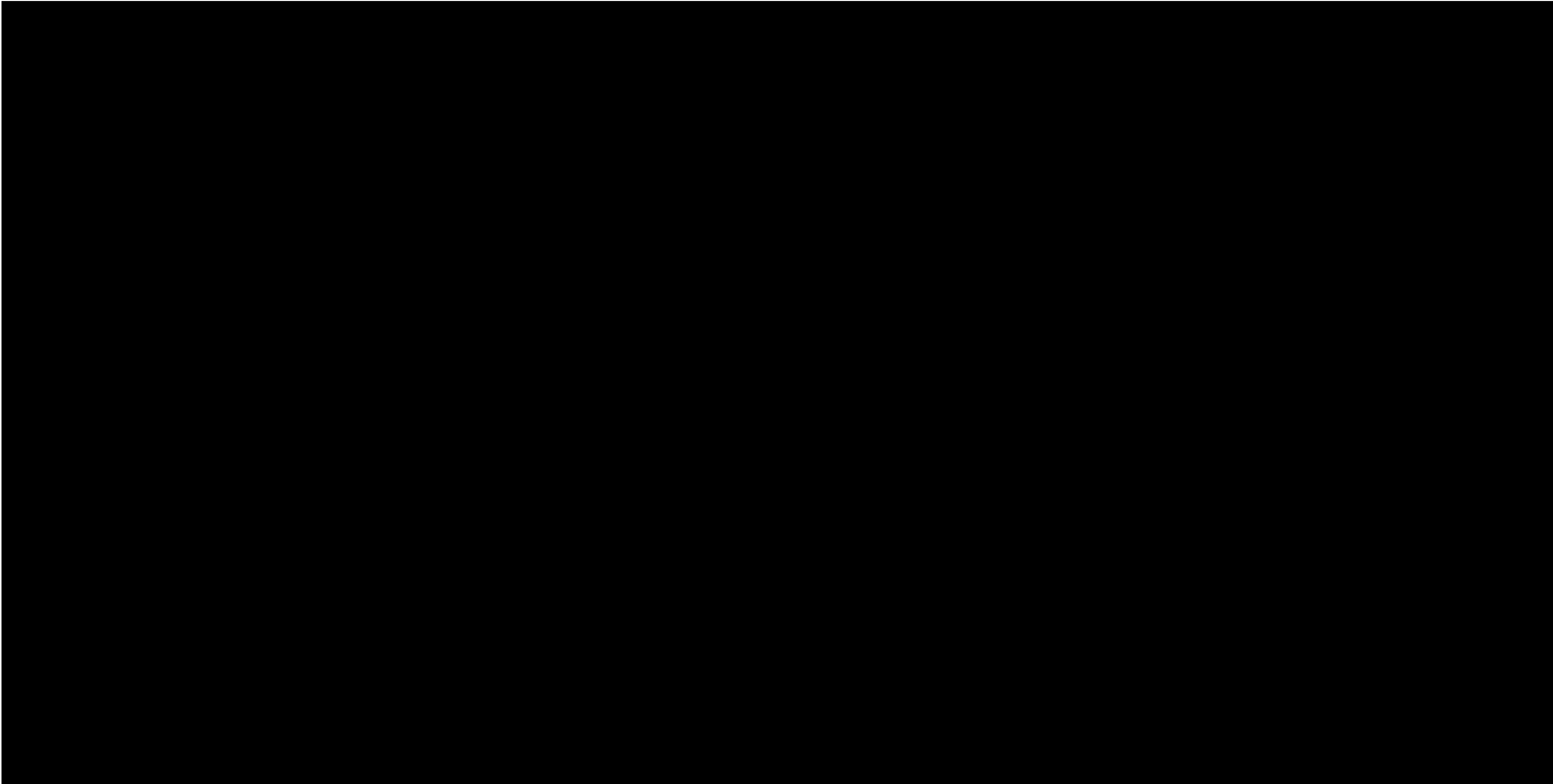


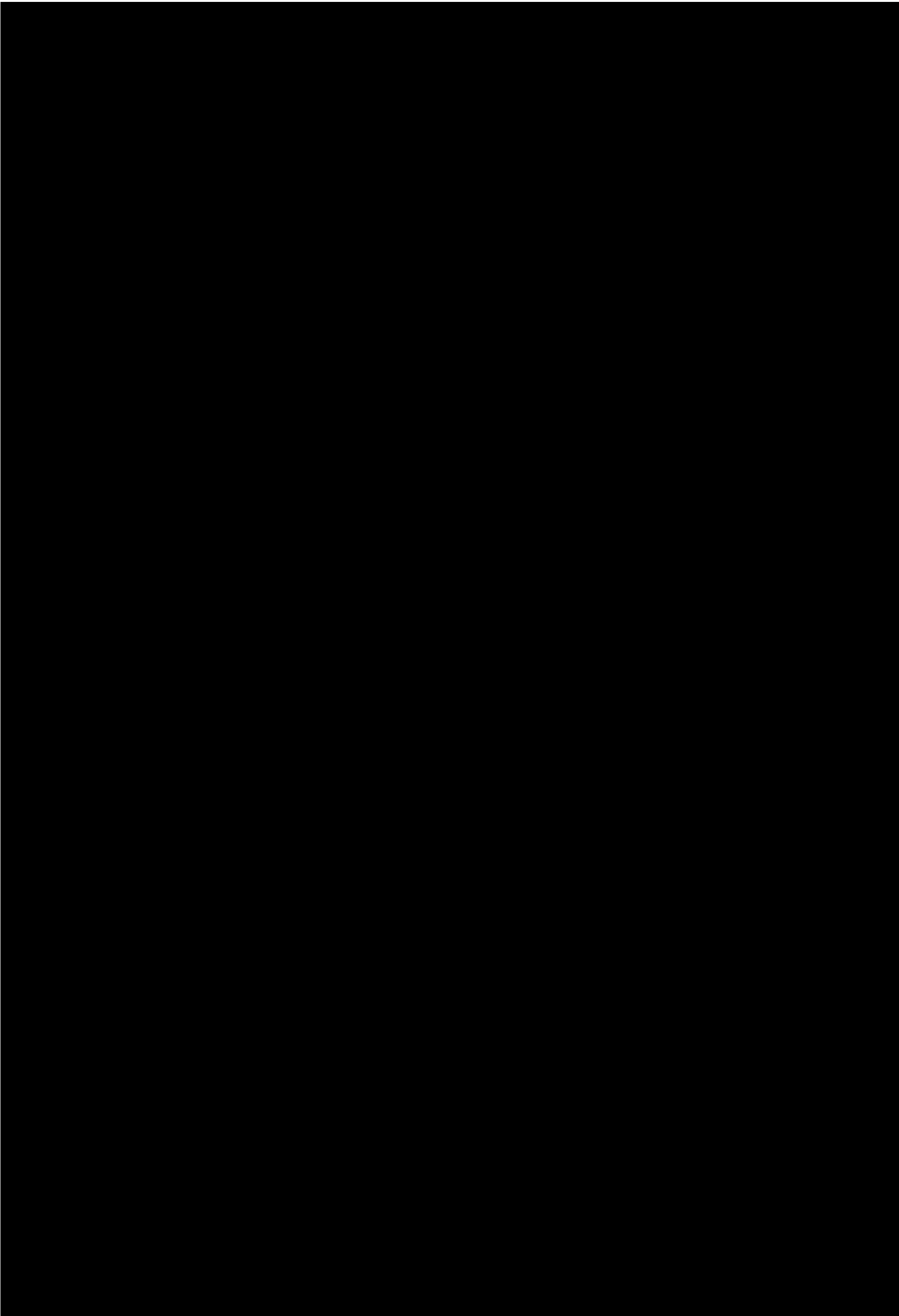


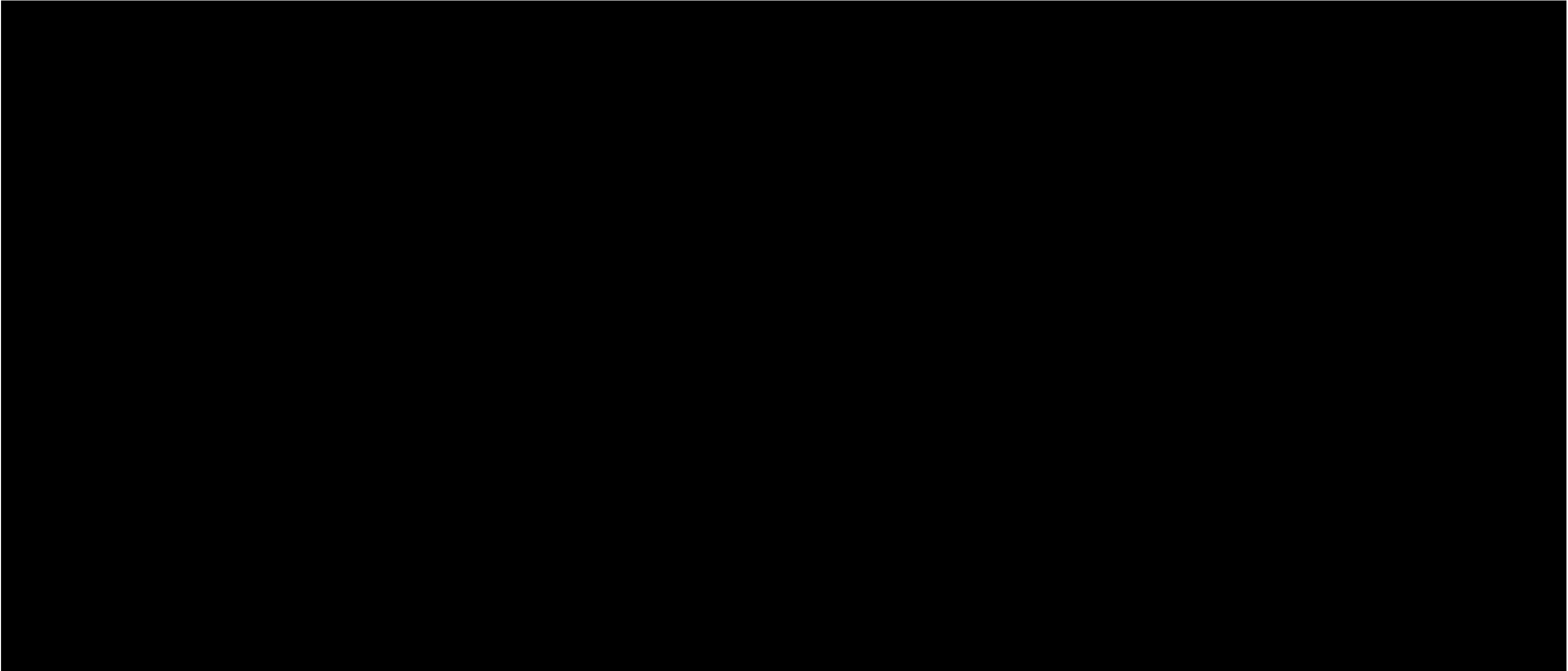




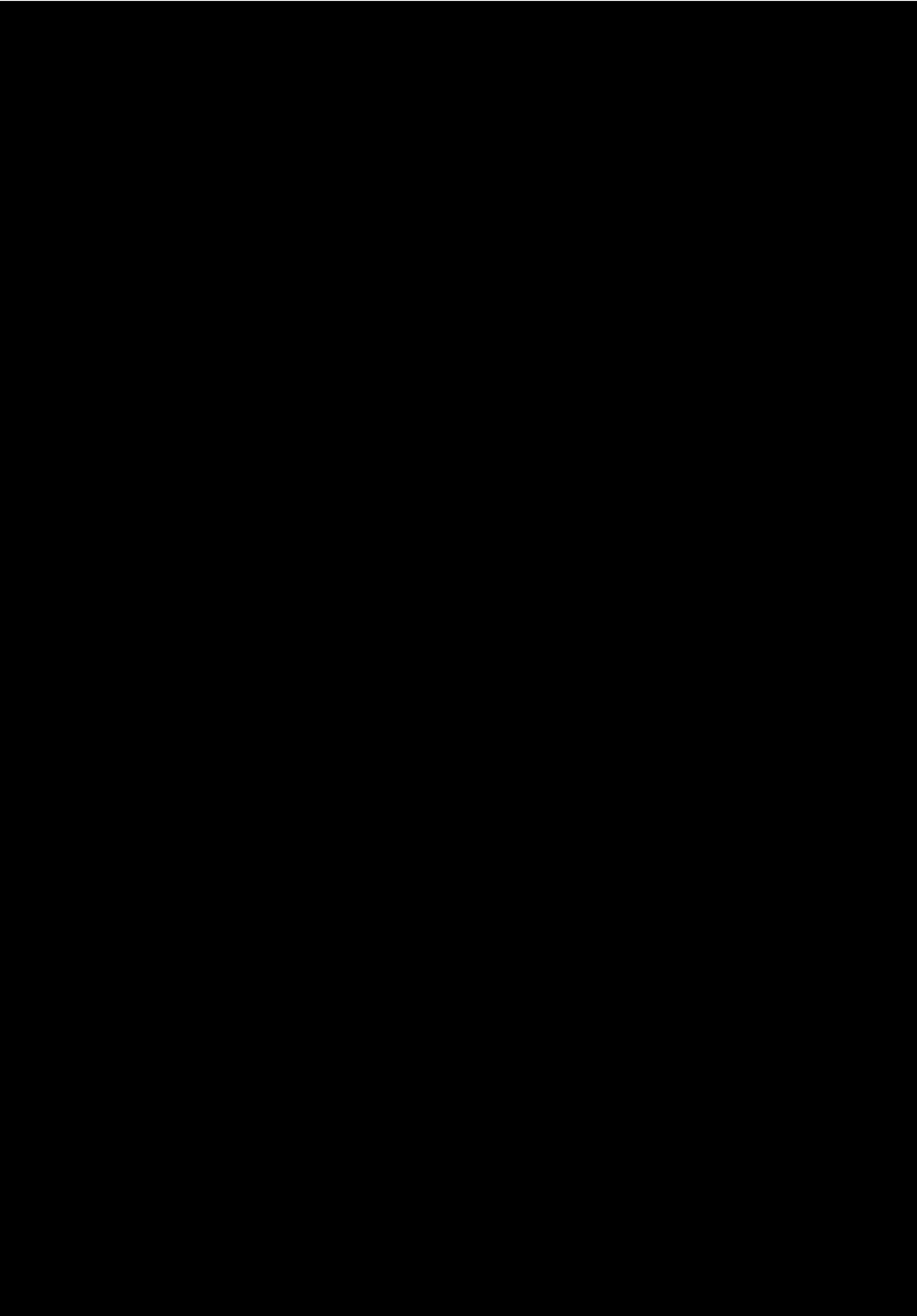


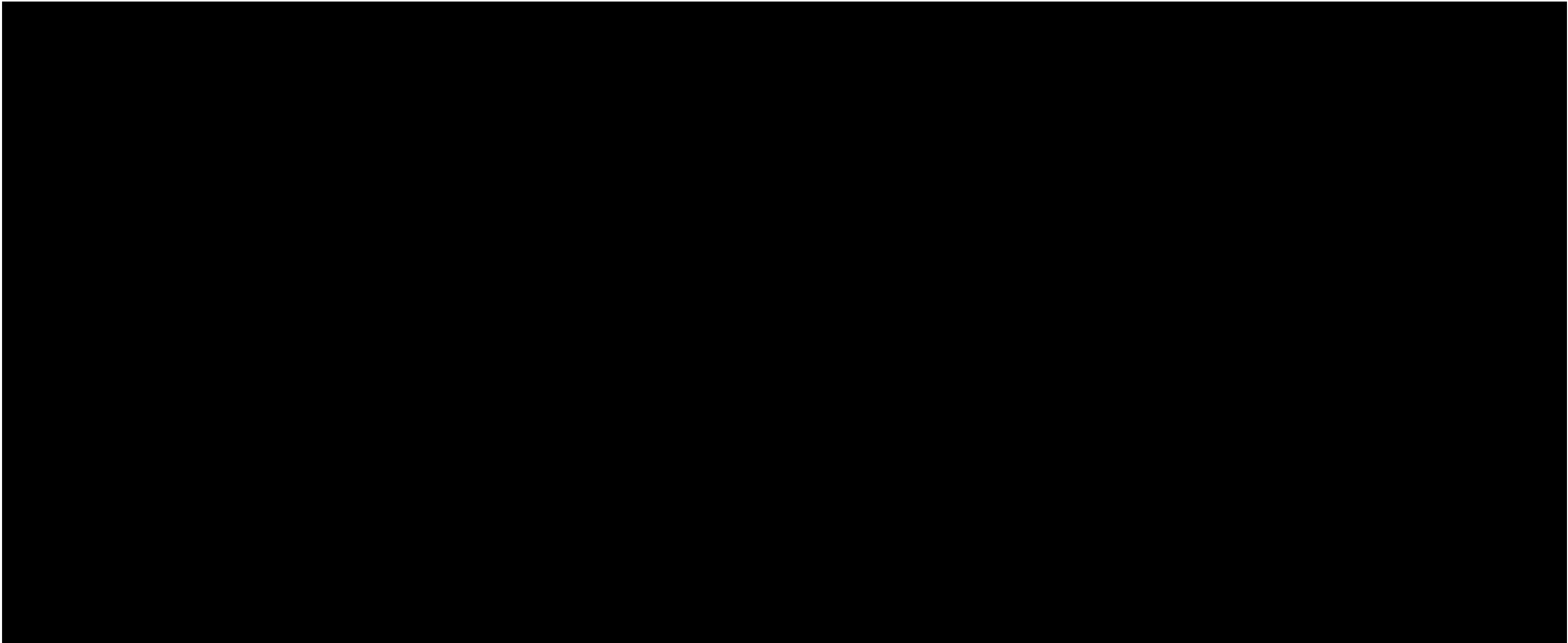


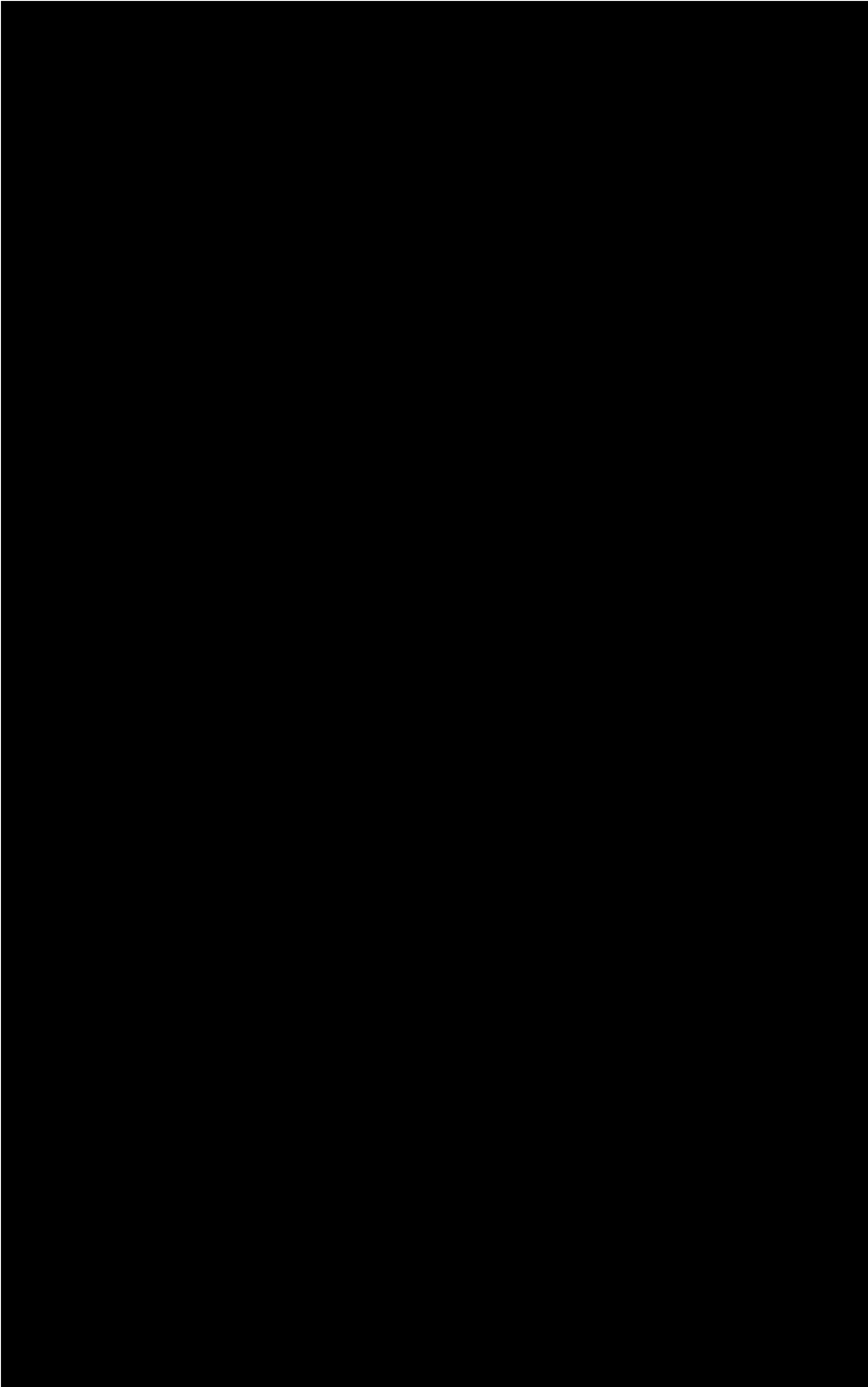


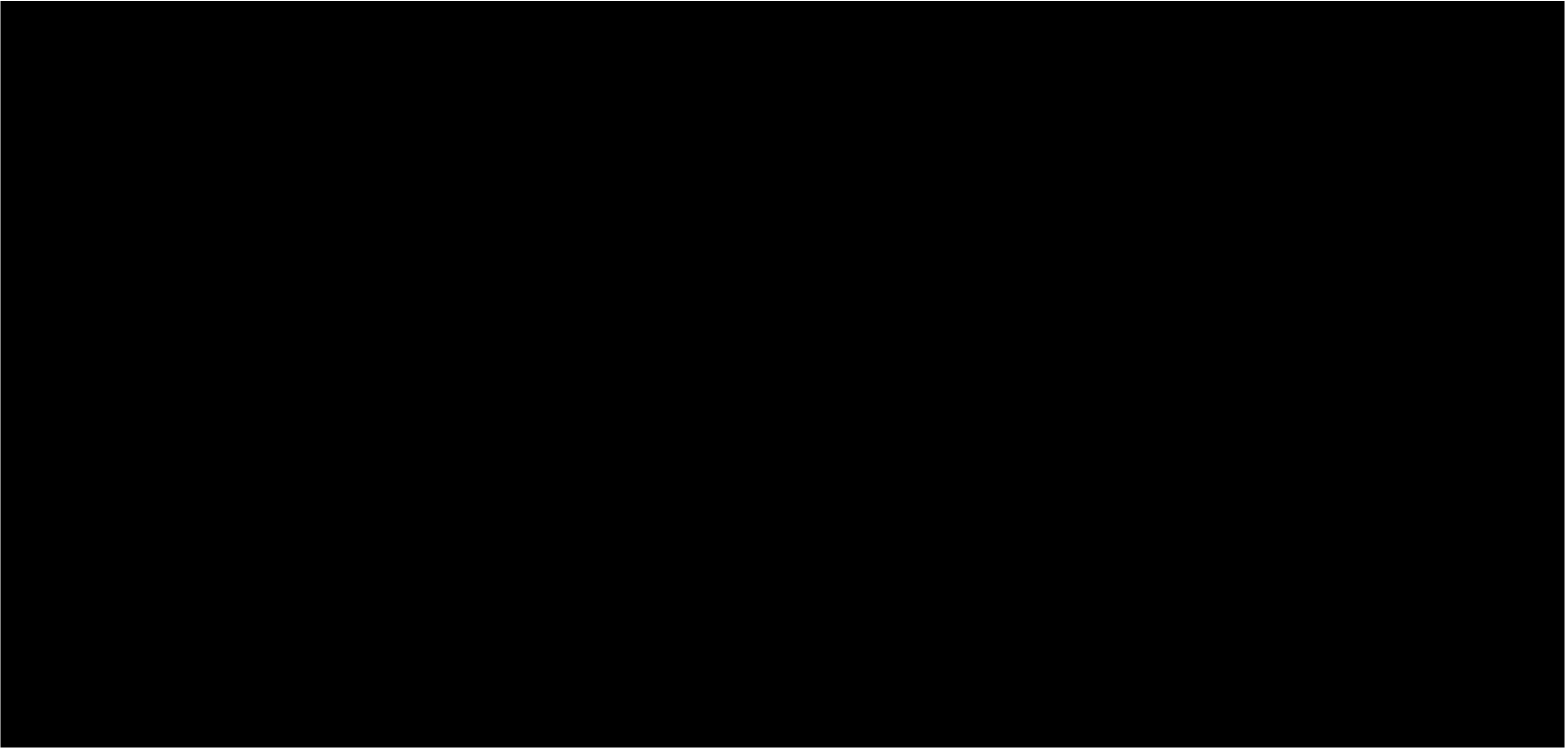


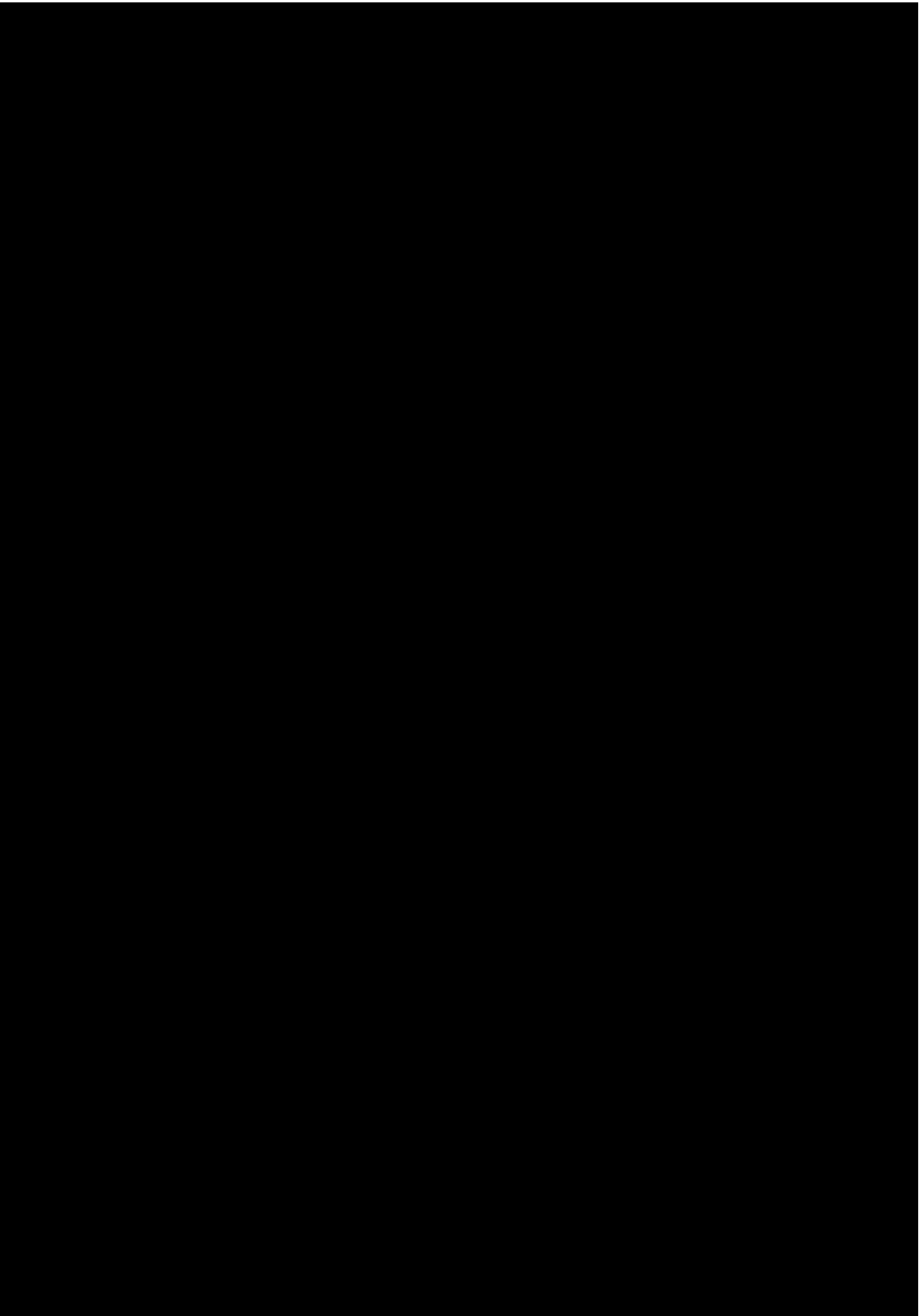


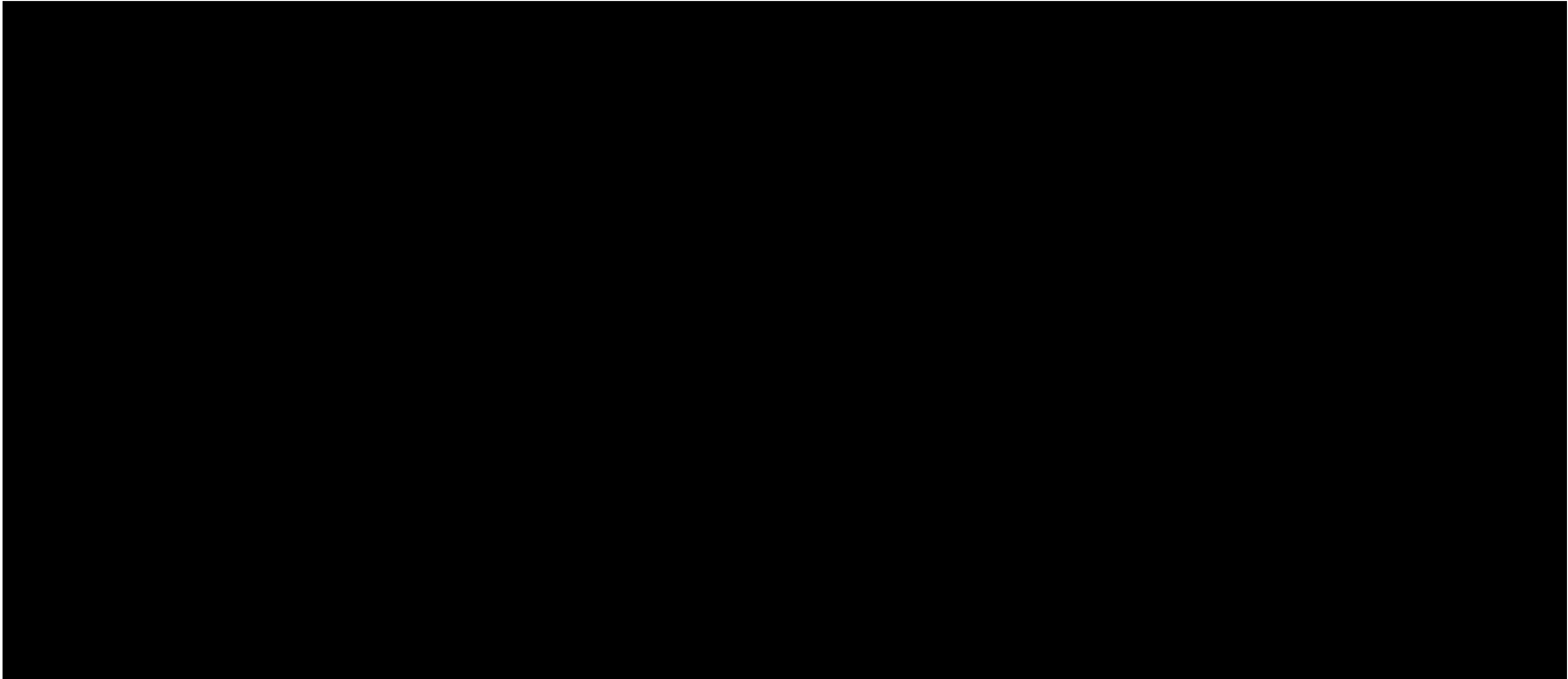


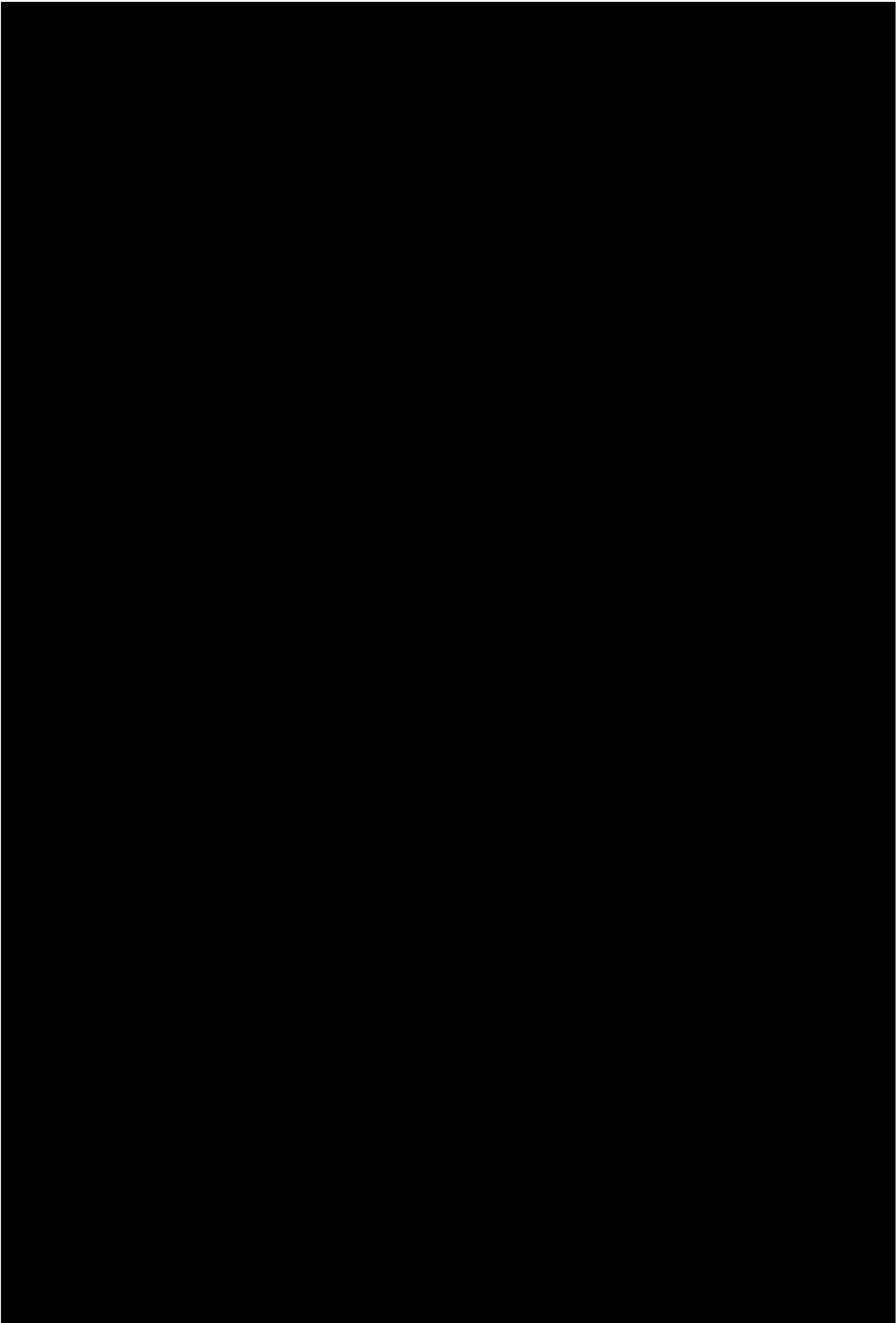


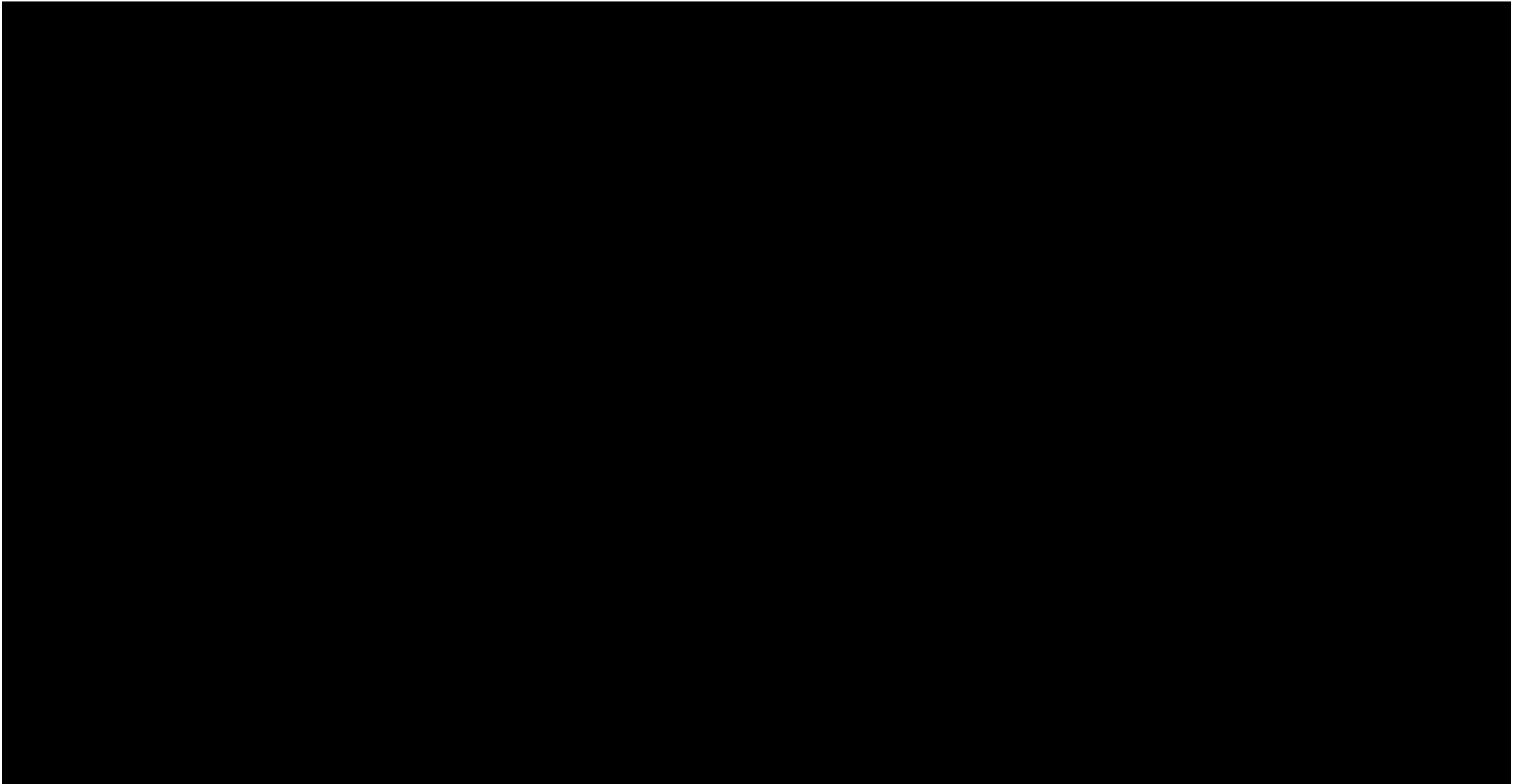














## Appendix C      Potential Impediment to the Yard Lead Alignment

<sup>27</sup> <https://www1.nyc.gov/assets/planning/download/pdf/about/cpc/130306.pdf>

<sup>28</sup> [http://www.brooklyn.cuny.edu/web/abo\\_misc/110901\\_MasterPlan\\_Presentation.pdf](http://www.brooklyn.cuny.edu/web/abo_misc/110901_MasterPlan_Presentation.pdf)

<sup>29</sup> <https://www.dasny.org/sites/default/files/rfp-documents/2018-06/Request%20for%20Expressions%20of%20Interest%20-%20Final%206-1-18R.pdf>

<sup>30</sup> <https://www2.cuny.edu/wp-content/uploads/sites/4/page-assets/about/administration/offices/fpcm/cucf/procurement/current/Addendum-1-to-Brooklyn-Coll-Business-School-Devel-RFEI.pdf>

<sup>31</sup> <https://www2.cuny.edu/wp-content/uploads/sites/4/page-assets/about/administration/offices/fpcm/cucf/procurement/current/Addendum-2-Questions-Answers-BC-Business-School-Devel-RFEI.pdf>

